Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER AND AMERICAN ELECTRICIAN.

VOL. LVI. NEW YORK, THURSDAY, DECEMBER 8, 1910. No. 23.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK.

JAMES H. McGRAW, President.
HUGH M. WILSON, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.
TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITOR.....W. D. WEAVER
A. S. M'ALLISTER.....Associate Editor
W. H. ONKEN, JR.....Associate Editor
W. E. KEILY.....Associate Editor
O. H. CALDWELL.....Assistant Editor
W. M. FINLEY.....News Editor
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CHICAGO OFFICE.....1570 Old Colony Building
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TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All Other Countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1909 was 945,850. Of this issue 17,500 copies are printed.

NEW YORK, THURSDAY, DECEMBER 8, 1910.

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EXPORT GAINS IN OCTOBER.

He would indeed be a pessimist who was not cheered and encouraged by the large gains in electrical exports listed for October. In face of a general trade movement notably slow and restricted, in view of what seems to be dulness in home conditions, electrical exports have increased steadily. The shipments of heavy electrical machinery for last October were valued at $514,184 as compared with $443,388 in the same month of 1909. In like manner, the foreign demand for electrical instruments and apparatus jumped from $683,819 to $780,233. The two items added together show a total of $1,127,207 as compared with $1,294,317, or a gain of $167,110 in the one month, and if maintained an increase in a year of just about $2,000,000. In fact, there seems no good reason why even that figure may not be bettered, for world trade appears to be expanding and getting into a more active state. The ten months' totals, for example, in light electrical goods are $5,797,726 and $8,133,929 respectively, while in heavy goods the figures are $5,031,910 and $5,898,042. At such a rate of increase as that the improvement in electrical exports in 1910-11 over 1909-10 may easily run between $4,000,000 and $5,000,000 and carry the grand total beyond any precedent.

ELECTRICAL VEHICLE TO THE FRONT.

As announced on another page, an energetic and well-financed campaign will shortly be started in favor of the electric vehicle, the movement being under the auspices of the recently formed Electric Vehicle Association of America and having the co-operation of some of the leading central-station men of the country. As the results of this campaign should be highly beneficial to the central station, it deserves the warmest encouragement and strongest material support from all connected with that industry and, as a matter of *esprit de corps*, of electrical men in general. The character of the men who have interested themselves in the work insures that it will be conducted along proper lines, and the financial resources available are such that the plans adopted will not be hampered in execution. By its initiative in this matter the Electric Vehicle Association of America has, in the first few months of its existence, justified the faith of its founders in the service that can be rendered by such an organization in a field luxuriant in neglected possibilities. For several years past this journal has been insistent on the value of the electric vehicle in its present state to the central station as an off-peak charging proposition, and it is gratifying to us to announce the movement now being started to drive this lesson home. Doubtless no small part of the indifference shown by the majority of central-station men to the electric vehicle had its rise in the unfortunate experience of ten years ago, when a somewhat sudden movement toward its general introduction had an unpleasant result in many central-station quarters. The present electric vehicle has, however,

little in common with that of the earlier period. The exact limitations of the storage-battery automobile are now recognized and observed, its electrical design is practically standardized, and several types of storage batteries have been developed to a high and apparently almost final state of efficiency for vehicular service. Further evidence of the vast change in conditions is offered by the warm advocacy to-day of the electric vehicle by men whose early experience with it created a prejudice that only irrefragable evidence as to its present commercial status could overcome. The present movement is thus not one in the interest of something of apparent merit commercially untried, but has to do with an opportunity no longer involving risk coupled with a situation dead ripe for development.

EXPERT TESTIMONY.

The expert witness has been subjected to a good many hard knocks and of late their severity has increased rather than diminished. We have commented on the matter from time to time and, in view of some recent and unusually severe strictures of the court on expert testimony, it seems appropriate again to point out some of the difficulties of the situation. The expert witness is in theory supposed to tell the plain unvarnished truth regarding the technical matters which are brought to his attention, but in point of fact his employer demands of him strictly *ex parte* testimony. That there are shady experts, just as there are shady lawyers, admits of no dispute, but it is as manifestly unfair to condemn experts as a whole as it would be to denounce the entire bar as similarly crooked. The real root of the trouble seems to lie, not in the personal or professional characteristics of the expert witnesses, but in the precedents which have come to govern the introduction and use of expert evidence. If one listens attentively to the taking of expert testimony, two facts stand out with unpleasant prominence. The first is that the witness, having to give his answers under oath in direct response to certain definite hypothetical questions, is not at liberty to go outside the range of the hypothesis, true or untrue, propounded. The second is that the hypothetical question as a rule represents not the actual issue concerning which technical information is wanted, but rather only such an approximation to it as may serve the purposes of counsel. Often a hypothetical question is ingeniously devised in such fashion that if it is answered truthfully the facts stated are far from those which would be elicited if the real issue were placed before the witness. Similarly, in cross-examination the questions asked very often lead directly away from the real issue toward some hypothesis which suits the convenience of opposing counsel. Then any effort on the part of the witness to bring his testimony straight back on the issue involved is denounced as irresponsive, and the witness is accused of attempting to pose as counsel.

It is little wonder, therefore, that expert testimony is often valueless and even misleading, not because it is incorrect or intended to deceive, but because it must, from the nature of the questions, bear upon fictitious issues. It is this feature of the matter which is most serious in limiting the value of expert testimony and to which is due much of the obloquy heaped upon the expert witness. As a rule, the witness goes into the case with a genuine desire to tell "the truth, the whole truth and nothing but the truth"; but the practice of introducing expert evidence is such as usually to forbid the whole truth being told, so that the witness with the best of intentions and with scrupulous regard for the obligation of an oath may yet have to answer questions in a way which leads to entirely wrong conceptions on the part of his untechnical hearers.

In view of some severe criticism of expert testimony from the bench it may not be improper to suggest that at least a partial remedy rests with the bench itself. Now and then when the real issue is becoming befogged the court exercises its prerogative of questioning the witness with very satisfactory results so far as the obtaining of justice is concerned. While there is as yet no provision for summoning experts by the court except under very unusual circumstances, there is no adequate reason why the court should not very much oftener than at present take a hand in the examination and thus clear up dubious points. Many an expert struggling to answer a misleading question without creating a false impression would be thankful to respond to pertinent questions from the bench. Habitual examinations of this kind might not be quite so satisfactory as summoning the expert directly by the court, but they would certainly tend to keep technical testimony from wandering away from the real issues of the case under the adroit leadings of counsel. We think that a judge who made a practice of asking a few questions on his own account would very soon come to take a more friendly view of expert witnesses than is now common, and would go far toward putting technical testimony in the way of fulfilling its proper function. When an employer pays out his good money to expert witnesses he expects good testimony—from his standpoint—in return; and under the present system the court only can check such a misuse of expert evidence.

THE MAGNETIC FIELD OF THE INDUCTION MOTOR.

When two reactors having an equal number of turns are connected in series in an alternating-current circuit, evidently the current in one is equal to that in the other, while the total e.m.f. is divided between the two coils in inverse proportion to the reluctances of the magnetic paths of the reactors. When the same two reactors are connected in parallel, evidently the voltage on one is equal to that on the other, while the total current is divided between them in direct proportion to the reluctances of the two magnetic paths. These well-known facts have a direct bearing on the distribution of magnetism around the air-gap of an induction motor, but it is not permissible to ignore other facts which may be of equal importance in this connection. A considerable portion of the coils of each phase-winding on an induction motor is connected in series, and the coils can in many respects be considered as reactors similar in every respect except as to the reluctances of the individual magnetic paths. The currents in the separate coils of a series circuit must necessarily be of equal magnitude, and hence the active m.m.fs. tending to produce flux along the magnetic paths must likewise be equal. When there is no opposing or disturbing m.m.f. the fluxes along the different paths will vary inversely as the several reluctances, so that inequalities in the air-gap reluctances must result in unequal distribution of flux around the air-gap when the secondary of an induction motor is on open circuit. However, many inaccurate conclusions would be derived by assuming the existence, under operating conditions with closed secondary, of the flux distribution found with the secondary open.

In a paper recently presented before the (British) Institution of Electrical Engineers, and noted in the Digest in this issue, Mr. C. F. Smith reported the results of an investigation of the irregularities in the rotating field of polyphase induction motors in which use was made of special search coils wound on the stator of two motors so as to embrace portions of the air-gap flux. In one case the author found pulsation e.m.fs. of 1 volt per turn where no voltages would have existed had the field been distributed sinusoidally in both time and space. In view of the fact that these e.m.fs. would have been in a position to produce numerous local currents in a squirrel-cage secondary, whereas in a coil-wound secondary the several pulsation e.m.fs. would have such time values that the resultant would be considerably less than the arithmetical sum of the separate e.m.fs., the author strongly intimated that the squirrel-cage motor would experience considerably more local heating by reason of such pulsation e.m.fs. than a motor having a coil-wound secondary. The fact of the matter is that a very small amount of local secondary current in the conductors of a squirrel-cage rotor is sufficient to eliminate largely the irregularities in the flux to which the e.m.f. producing the local current may be attributed. This local current cannot be considered as a true transformer secondary current, for it has almost no effect upon the total flux produced by the primary exciting current; it acts, in fact, almost wholly as the source of a local m.m.f., tending to wipe out the irregularities in the distribution of magnetism around the air-gap. Since to this particular m.m.f. there is almost no opposing m.m.f., the local current required for smoothing out the irregularities in the field is small in value. It is greatly to be doubted if the extremely slight reduction in the local currents in a coil-wound secondary over the currents in a squirrel-cage secondary could be considered as showing any advantage whatsoever of the former over the latter. To the extent that any extra currents do exist, the field in the squirrel-cage motor is more nearly regular than is that in the machine with a coil-wound secondary, and this condition is advantageous rather than disadvantageous.

GRAPHICAL SOLUTION OF PROBLEMS INVOLVING PLANE-SURFACE LIGHT SOURCES.

The distribution of illumination over the surfaces of the floor, walls and ceiling in a room lighted by a single point-source of light, such as a pendent single incandescent lamp, is well understood by illuminating engineers. The equilux lines are concentric circles on every such internal plane surface of a rectangular room. If the room were spherical with the point-source at the center, the incident illumination would, of course, be everywhere the same, and there would be no equilux lines. When, as in the ordinary practical case, the single pendent lamp is to be considered as giving equal luminous intensities in different azimuths or to the different points of the compass, but with unequal, although known, luminous zonal intensities, the illuminating engineer has well-known rules for determining the incident illumination on floor, walls and ceiling, although they are, of course, more complex than those pertaining to the ideal luminous point-source. In general, in such a case with a vertical lamp the equilux lines are circles on the floor and on the ceiling, but on the walls they are either non-circular loops or segments of the same. Moreover, when a room is directly lighted by a plurality of such varying zonal-intensity lamps, in assigned positions, it is quite possible, although it is perhaps a time-consuming task, to find the distribution of illumination incident all over the room from each lamp in turn, and then sum up these individual distributions in order to arrive at the resultant total distribution. But when, as is coming into practice, a large room has been lighted by a circular opalescent area in the ceiling, this area having approximately uniform luminous intensity, there have been no engineering methods available for treating the case. That is, the only known methods have been physicist's methods or mathematician's methods, which are too complex for the engineer ordinarily to employ and which belong to a different intent and category.

A distinct step in advance is made, therefore, in illuminating engineering by the graphical process contained in Dr. A. S. McAllister's article on this subject, appearing on page 1356. It will be seen that, starting with the beautiful proposition that the normal illumination within any spherical surface containing a uniform luminous disk is uniform and inversely proportional to the square of the distance from the edge of the disk to the point on the sphere opposite the center of the disk, the engineering solution of the case is presented by a very simple graphical process. The equilux lines, if the room were a true sphere of this description, would disappear as in the point-source case. With a rectangular room the equilux lines on the floor are all concentric circles. The equilux lines on the walls are eccentric circles with their centers regularly displaced along a vertical straight line, like the lines of magnetic force around each of a pair of long, straight, parallel active conductors. On the ceiling, however, there are no equilux lines of incident illumination, or, stated in another way, the dispersive properties of the ceiling, so useful with pendent lamps, are here dispensed with as regards direct illumination in favor of the dispersion of the rays incident from the luminous disk occupying a part of the ceiling. In many practical cases the light-giving surface in the ceiling, usually a plate of translucent glass illumined by incandescent lamps supported in a space above the ceiling, is not circular, but square or rectangular. In such a case, of course, the graphical construction given no longer strictly applies. Nevertheless, in most cases likely to arise in practice the departure from the circular form will not be so great but that a satisfactory degree of approximation can be obtained by substituting in the diagram a truly circular disk of the same area and total luminous flux as the actual rectangular area.

Over and above the distribution of directly incident luminous intensity as given by this method is superposed the reflected and scattered illumination. If the walls and furniture in the room are dark and absorptive, the extra amount of illumination derived from incident light reflected and returned in this way will be small, but if the walls and furniture are light and non-absorptive, the ceiling or that part of it outside the light-giving area will come prominently into play and will add materially to the total illumination, just as in other problems of interior lighting. The illuminating engineer usually satisfies himself that the direct illumination is adequate for the purposes of the chamber under consideration and then trusts to the scattered additional illumination for a bonus over and above the common stock. Just as in the industrial world, it is remarkable how much the magnitude of the bonus depends on the local conditions. In some cases if the bonus of scattered and re-incident illumination compensates for the depreciation of the luminous intensity of the light-sources during the term of their natural existence, the illuminating engineer is content.

Electric Vehicle Campaign.

A complete and comprehensive plan for the further development and extended use of the electric vehicle has just been formulated under the auspices of the Electric Vehicle Association of America, which has appointed a publicity and advertising committee for the purpose indicated. Mr. N. F. Brady, first vice-president of the New York Edison Company, is the chairman of this committee, which includes in its membership the following leaders in the electric lighting industry:

Messrs. N. F. Brady, Samuel Insull, J. B. McCall, C. L. Edgar, W. W. Freeman, Charles R. Huntley, Alexander Dow, George H. Harries, Samuel Scovil, F. W. Frueauff, H. M. Byllesby, J. G. White, A. H. Ford, T. N. McCarter, Thomas Dolan, R. F. Pack, Arthur B. Lisle, Marcy L. Sperry, R. M. Searle, John B. Miller, John A. Britton, Alton S. Miller, G. W. Brine.

This committee held a meeting Saturday morning, Dec. 3, in New York, at which it was decided to undertake a publicity campaign along broad national lines, and that in order to make such a campaign effective on the scale contemplated it would be necessary to expend a minimum of $50,000 annually for at least three years. The general idea is to utilize the magazines and trade papers of national circulation. It was felt that very much more than the sum mentioned could be used to advantage, but that the amount specified was the least with which such a campaign could be inaugurated. Practically half this amount was subscribed by those present at this meeting.

A sub-committee was appointed to present the matter to all those interested and solicit definite subscriptions. This committee consists of Messrs. W. W. Freeman, Brooklyn, chairman; Frank W. Frueauff, Denver; Alton S. Miller, St. Louis; Arthur B. Lisle, Providence, and R. M. Searle, Rochester. The sub-committee held a meeting immediately after the general committee adjourned and decided to begin at once the solicitation of subscriptions from central stations on the basis of 1/25 of 1 per cent of the gross income of each company. It was felt that this would give all the electric lighting companies a definite basis of subscription in proportion to the benefits to be received from such a campaign.

The well-founded expectation is that the total amount of subscriptions from central stations will be substantially duplicated by the manufacturers and others interested in the sale of apparatus.

Water-Power Development Policy.

A plan to bring together the advocates of federal regulation of water-power and those who stand for State regulation on a water-power policy upon which both can agree is being considered by the executive committee of the National Conservation Association, of which Mr. Gifford Pinchot is president.

The object of the plan, which was drafted by Mr. Philip P. Wells, counsel for the association, who, as former law officer of the Forest Service, had a large share in devising the system of water-power regulation in national forests, is to afford a water-power platform on which both sides of the water-power controversy may unite to protect the public interest, and at the same time encourage the development of the many millions of horse-power now going to waste in the mountain streams of the far West and the great rivers of the central and eastern parts of the country.

The proposed plan, which is stated to be the result of long and careful study of the water-power question, has, it is announced, been laid before competent engineers of wide experience in water-power development and officers and managers of hydroelectric power companies, who have criticised it and approved it.

The basis of the plan is development without delay, waste or the sacrifice of other and higher uses of flowing water. For this, the plan holds, private capital must be aided by the state or nation through corporate franchises, condemnation of private property and licenses to use public lands and obstruct public waters, etc. Under the plan the power companies are to have certainty of tenure for a reasonable time and a chance for generous profits upon their actual investment. For the public the plan promises good service, fair prices, full publicity as to cost, honest capitalization and fair rentals for public property used by the companies.

It is conceded in the plan that the federal government has no jurisdiction unless its land is to be occupied or navigable rivers are affected. Even in such cases the regulation of service and prices is to be the function of the state, leaving to the national government the duty of securing prompt, full and orderly development, a reasonable time limit for the leases, publicity as to financing, and fair rentals for federal property used, perhaps paying a part of the proceeds to the state.

The plan includes logical development in order that the future may not be handicapped by ill-advised partial early development and compulsory development in cases where water-powers are held for speculative purposes. Among other points are authority to acquire private lands by application of the principle of eminent domain; to assess the cost of water storage upon lands and power sites benefited thereby; when desirable, public construction and ownership of storage reservoirs and transmission lines; irrevocable leases and franchises during a fixed period; adjustment of rental values; court adjudication upon forfeitures and other penalties for breach of the conditions of a franchise, privilege or lease; fair compensation for property at end of lease; equal service to all consumers without discrimination; capitalization on the basis of cost and publicity of accounts; continuous operation of plant to prevent artificial limitation of output to raise prices or restrict service.

Canadian-American Hydroelectric Power Conflict.

The town of Fort Frances, Ontario, has given notice that it will apply to the Dominion Parliament at the present session for an act to repeal certain powers given to the American Ontario & Minnesota Power Company. The town wants its rights to be more clearly defined in respect to the quantity and character of power or electrical energy to be supplied by the power company from the development on the Rainy River to the Falls of Fort Frances, and to fully determine the rights of users of power on the Canadian side of the international boundary, as well as prices and conditions under all circumstances.

The town of Fort Frances took opportunity at the time of Premier Sir Wilfrid Laurier's recent visit to western Canada to urge cancellation of the Ontario & Minnesota Power Company's charter on the ground that the company was not living up to the terms thereof and that it was preparing to export to the United States the energy developed on the Canadian side of the river to the detriment of the interests of the town of Fort Frances. A review of the controversy was given in our issue for Sept. 22, 1910.

St. Lawrence River Power Development.

The project for the development of additional power at Beauharnois, Que., brought to Ottawa on Nov. 30 representatives of the Canadian Light & Power Company, the Montreal Light, Heat & Power Company, the Montreal Cotton Company and the Richelieu & Ontario Navigation Company before a committee of the Dominion government consisting of Hon. Dr. Pugsley, Minister of Public Works; Hon. George Graham, Minister of Railways and Canals, and Hon. L. P. Brodeur, Minister of Marine. Opposition to the project was listened to, plans were required, and the matter was held over for a further study by the engineers.

The plans of both the Beauharnois and the Canadian Power

companies provide for the enlargement of the intake and the consequent withdrawal of more water from the St. Lawrence River. Mr. Francis King, representative of the Dominion Marine Association, declared that if the plans were carried out the Richelieu boats would touch bottom in the Coteau Rapids. Mr. C. J. Smith, general manager of the Richelieu Navigation Company, stated that there was little enough water at present and navigation was so difficult that only two pilots were able to take the boats through. Last summer the boats rubbed bottom, and the loss of water would be very serious. Hon. Dr. Pugsley said the government's resident engineer had reported that navigation would to some extent be affected by the carrying out of the proposed plans, and the committee decided that further study should be made and the matter taken up at a later date for further consideration.

Ohio Telephone Situation.

According to reports in circulation in Ohio at present the new General Assembly, which will convene early in the year, will undertake to solve a complex telephone problem. It is expected that a bill will be presented providing for the segregation of the local and long-distance systems and the merger of the former under the ownership of one large company. Through this arrangement the long-distance lines will also be brought under a single ownership, but no legislation is needed for this, as it will be of the nature of interstate business and will come under the control of the Interstate Commerce Commission.

For some time the tendency has been to merge Bell and Independent local companies in the various towns of the State on condition that the wires of the American Telephone & Telegraph Company be given connection with the consolidated exchange, as well as those of the United States Telephone Company. For years this move was fought by the Independents until a court decision was handed down opening the way for both. Following this shortly came the announcement that J. P. Morgan & Company had secured a controlling interest in several of the largest Independent local companies in the State, as well as in the United States Telephone Company. Several suits, instituted by minority stockholders, were filed in an endeavor to prevent the transfer of stock, but it is understood that they are well out of the way. For many months seemingly no opposition has been made to the consolidation of local exchanges of the opposing forces, and it would appear that this is being done in preparation for greater things to follow.

The opinion has been expressed that the Bell companies have found it impossible to finance both long-distance and local service for the entire country with the companies now in existence and that the management has concluded to divide the business so that the Bell companies can take the long-distance business and place the burden of financing the local exchanges upon those now interested in the independent work and others who may be induced to invest. This plan, it is said, was worked out by J. P. Morgan & Company, and, while this firm will thus make good its word that no giant merger of the Independent and Bell interests would result from the acquisition of control of a number of Independent companies, it seems now that two big systems will be the outcome, one of which will at least nominally be controlled by the Independents or by local people, while the other will still be owned by the original Bell companies.

It is believed by many that one company will be organized to purchase all the local exchanges in the State, both Bell and Independent, and that in all towns and cities where a dual service exists the exchanges will be consolidated. The argument will be that a better and more extended service can be given through the operation of this plan, and that on an average the expense to the subscribers will be lower. But in order to work this out and be free from litigation the Legislature must enact laws that will legalize the plans, and it is believed that the proposed law will place the business under the control of a State commission similar to the commission provided for in the Elson bill which was defeated last winter. It is possible that, with proper safeguards as to rates and quality of service, there would be no objection to making a single system possible, but should there be opposition to such restrictions the fate of the move would be in doubt, as the spirit of the people of Ohio just now seems to be toward curbing the freedom of public-service corporations, even to the point of forcing bad service.

Considerable preparation has already been made toward some step in the telephone field. Audits and appraisements have been made in many cases, and no doubt an immense collection of data is now in the hands of someone that can be utilized quickly in case the issue is successful in all its various features.

A number of conferences have been held in Columbus within the past few months by telephone men, the last one having taken place less than three weeks ago. While it is not known what the purposes of these meetings were, the supposition now is that the forces were being marshaled in readiness to push the proposed bill through the Legislature. Leaders among telephone men realize that they will have a hard task, because of the bitterness engendered a year ago and the fact that it has been decided that rules regarding the lobby in legislative halls will be more strict than ever during the coming session. This should not hinder a bill honestly presented, with all its purposes clearly shown, nor is it believed that a bill handled in any other way will be successful, since suspicion once awakened will not down easily within a short space of time.

Should such a plan be worked out in Ohio it would doubtless be extended to all States where Independent telephony has gained a foothold. Besides Ohio, this would include eastern New York, eastern Pennsylvania, West Virginia, Kentucky, Indiana, Michigan, Missouri and a number of other Western and Southwestern States. Ohio would be the pattern for the others and similar laws would probably have to be enacted in all the States before the plan could be executed. This would probably require several years, so that the service under the plan would be extended gradually.

Cooper Hewitt Light-Transforming Reflector.

Combined with the many highly advantageous features of the mercury-vapor lamp is the lack of red rays in the light emitted therefrom, which renders the lamp unsuited for use where accuracy of color vision is an essential feature. In industrial establishments the lamp has been found thoroughly satisfactory, but in many other locations the lack of red rays has precluded its exclusive introduction. Good results have sometimes been obtained by using with the mercury-vapor lamp some other lamp giving light rich in red rays, and many schemes of a somewhat similar nature have been proposed for overcoming the color defect. The "filter-screen" plan, which can be used with certain types of lamps to change the resultant color of the light, has been tried with the mercury-vapor lamp, but the results could not be other than disappointing. A color screen absorbs all rays except those of the color desired. Evidently, therefore, a red glass screen used with a mercury-vapor lamp would absorb all of the visible rays except red and, there being no red rays emitted by the lamp, would appear black. That is to say, the colored glass screen subtracts certain rays from the light, but it cannot add other rays which do not already exist in the light. A more promising field for investigation resides in the addition to the mercury vapor of some substance the spectrum of which is rich in red so that the resultant light from the composite vapor may possess all of the colors of the spectrum. However, not much progress has been reported along this line.

An entirely different scheme that bids fair to overcome the deficiency in the color quality of the light from the mercury-vapor lamp is one involving the use of a so-called light-transforming reflector. This reflector has been evolved as the result of investigation carried on by Dr. Peter Cooper Hewitt.

While it is being developed for the market primarily for use with the Cooper Hewitt mercury-vapor lamp it can be employed equally well with other types of lamps for the purpose of adding red rays to the light emitted therefrom.

The reflector differs only slightly in shape from those usually employed with the lamp, but it performs an important function which strongly differentiates it from other reflectors, namely, it acts as a secondary source of light radiation. That is to say, the light falling upon it is not wholly "reflected," but a part is absorbed, while light of a different frequency, that is, different color, is produced and emitted from the surface at which the initial light was absorbed. The reflector surface itself is formed of white light-diffusing material, upon which is placed a thin layer of florescent material; it is the latter material which acts as a "frequency transformer" to absorb certain of the rays from the lamp and deliver lower-frequency rays in place thereof. When used with a mercury-vapor lamp the florescent material emits red rays to supply the deficiency in these rays in the light coming directly from the lamp.

In the form of reflector now being prepared for the market for the near future the florescent material is placed on sheets of cardboard paper so mounted that they may be removed readily in case deterioration takes place while the lamp is in service.

The Garaging of Electric Vehicles.

In a paper read before a meeting of the Electric Vehicle Association of America in New York on Nov. 29 Mr. C. L. Morgan, manager of the maintenance department of the General Vehicle Company, read a paper devoted to the proper garaging of commercial electric vehicles. The author stated that unless an owner possesses at least five vehicles he should keep his vehicles at a public garage, where the labor cost is relatively smaller and energy can be purchased at a more favorable rate than at a private garage.

In any garage the keynote of the installation should be simplicity, and the equipment should be as nearly "fool-proof" as possible. It is essential to lay out an absolutely rigid program for the inspection and adjustment of the vehicles and charging equipment, and some one person should be held personally responsible for the execution of the program. Mr. Morgan cited one case where twenty-six machines are properly cared for and kept in excellent physical condition by three workmen, one being on duty during the daytime and two during the night. He claimed that any man of ordinary intelligence can properly care for and operate successfully a modern electric vehicle provided the battery is not overworked.

Mr. Morgan called attention to the garaging methods employed by the New York Transportation Company, which provides an adequate system of inspection of vehicles and batteries. Proper charging is attended to and the batteries are regularly flushed and equalized. A room is provided for drivers and this is the only place where they are welcome, but to insure perfect co-operation and harmony a system of drivers' complaints is in operation. Each driver makes out his complaint in duplicate. These are turned over to the night foreman and later the driver is obliged to certify to the elimination of the trouble because parts have been replaced or because adjustments have been made. The night inspectors on finding work necessary within the next few days report the fact to the superintendent, who hands to the driver a slip requesting authority to make the needed adjustments or repairs. In nine cases out of ten the driver is authorized to order such work; and, as in the case of complaints, later certifies in duplicate to the work having been done. If the driver does not authorize the work the necessary repair is at once called to the attention of the owner with a brief explanation of the need for the work, with the result that it is ordered done and finally certified to by the driver. These various duplicate records are attached to the monthly bill, thereby eliminating once for all discussion regarding services rendered.

Tantalum Lamps for Car Lighting.

As the result of an exhaustive investigation the Chicago Railways Company has satisfied itself of the marked economy to be effected by the use of tantalum lamps for car lighting, compared with carbon lamps. This is particularly true in the case of a company which, like the Railways Company, purchases its energy from a central-station supply.

The company has installed tantalum lamps in nearly 1000 large pay-as-you-enter cars. The investigations show an average saving of 5 cents a day per car on the basis of 1800 hours of illumination per year. This means a present saving of $18,000 a year, and fully $35,000 a year will be saved when the tantalum lamps have been placed in all of the 2000 cars to be finally operated by the company. The greater cost of the tantalum lamps compared with carbon lamps, including interest, is found to be balanced at the end of the first year by the longer life of the former lamp. The saving, of course, is in the reduced cost of electrical energy consumed.

Twenty-seven lamps are used in each car; seven are 32-cp lamps and twenty are of the 16-cp size. Twenty-one lamps are used for interior lighting of the car and the remainder are used for platform lighting, head lighting and illuminating the sign boxes. The platform and headlight lamps, as well as three placed in the ceiling of the car, are of the 32-cp size, all of the others being 16-cp lamps. After extensive testing a standard tantalum lamp rated at 35 watts for 16-cp sizes and 70 watts for 32-cp sizes was installed on nearly 1000 of the new cars of the Chicago Railways Company. These lamps are manufactured by the Bryan-Marsh Company. Records covering a large number of cars show that the renewals per car per month range from 1.72 to 2.59. Comparing the amount of electrical energy required for a car using twenty-seven tantalum lamps with a similar equipment of carbon lamps a saving of 1301 kw-hours on the basis of 1800 hours' lamp burning during the year is shown at the switchboard. Furthermore, during a test of 600 car-months the renewals with carbon lamps were found to be 4.27 per car-month and with tantalum lamps 2.21 per car-month.

Proposed New York Subway Construction.

Mr. Frank J. Sprague has submitted to the Board of Estimate and Apportionment of the City of New York a second communication relating to the subway situation, with special reference to certain financial considerations. The present communication is supplementary to an earlier communication noted on page 1226 of our issue for Nov. 24. Mr. Sprague claims that if the action of the Public Service Commission shall be as contemplated it will become the duty of the board addressed to assume the responsibility of deciding the following nineteen problems:

1. Whether the natural nucleus of a system owned by the city but, under administrative and supervisory city control, temporarily operated by a tenant, which has cost $63,000,000 and against which the city has issued a total of $50,400,000 of bonds (or, if the Steinway tunnel project should materialize as proposed by the Public Service Commission, a system which will have cost, exclusive of equipment, $72,500,000, with outstanding city bonds of only $52,000,000), shall under any possible conditions have its operation extended with a single fare over sections competitively built wholly or in part with city funds and with city participation in profits.

2. Whether in lieu of such operative extension a separate system shall be constructed by the city, and in such manner that it cannot at any time be amalgamated with the system the city already owns, either in the near future or at the termination of the present lease, no matter how necessary or advisable.

3. Whether routes and franchises shall be selected by an operator as an adjunct to any system, and sections already built shall be excluded from operation.

4. Whether in providing city money for construction any interest shall be debarred from equal rights in bidding for the same.

5. Whether if an independent line is to be built and operated it must accept the "tri-borough" route.

6. Whether the users of the subways of New York shall be limited in their need to a single fare, or to get to their destinations they shall often be called upon to pay two fares.

7. Whether there shall be established a disjointed system made up of three independent sections having no apparent relation with each other and affording no through traffic between the several boroughs of the city.

8. Whether an existing rapid transit route shall be duplicated to the exclusion of vitally needed demands elsewhere.

9. Whether the Borough of Manhattan shall be developed to the exclusion or long-time delay of its neighboring boroughs.

10. Whether under the misleading cry of a "$100,000,000 system" the city shall undertake a project which will finally cost it fully $90,000,000 more than this, exclusive of a private investment of nearly half as much more for cost of equipment.

11. Whether the system shall be constructed without an operative tenant in sight, or any knowledge whether such a tenant can ever be obtained under the terms and conditions governing the city's investment in the present subway.

12. Whether, in case any such operator cannot be secured on terms satisfactory to the city, it will be prepared to supply the $44,000,000 necessary to become its own operator.

13. Whether the city is to abandon its previous attitude with regard to the lease of a city-built road and permit private capital to have a prior lien upon net earnings.

14. Whether tunnel dimensions and unnecessarily elaborate station planning shall be approved which shall together impose at least $30,000,000 excess cost, in the hope of getting a foreign corporation for a tenant, unless such corporation is now prepared to make a firm bid agreement to pay the city 5 per cent on at least $27,000,000 of this excess.

15. Whether the sometime possible wishes of a Connecticut commuter shall take the place of the twenty-four-hour demand of the people of New York for more extended facilities.

16. Whether there shall be an unnecessary delay of two or more years in getting new subways into operation, on top of the time necessary to get a better and more convenient subway under operation.

17. Whether there shall be approved a system of operating trains on heavy grades and curves under conditions which are a constant menace to life.

18. Whether a short fat subway covering a limited territory shall be built within the limits of a given appropriation, or whether a subway of ample effective size shall for the same money be extended fourteen miles farther into territory vitally needing such extension.

19. Whether it is not the part of wisdom, while awaiting consideration and possible rejection of the present plans, to direct the energetic preparation of new ones on amended dimensions and with simpler station construction to meet the consensus of engineering criticism; also at the same time to plan for an alternative one-level route down Seventh Avenue, so that competitive construction and operative tenders can be asked for.

Mr. Sprague expressed the opinion that, following whatever general conclusion may be arrived at by an advisory committee, it is possible, with the advice of a competent engineering board, to arrive quickly at a satisfactory result.

Mr. William G. McAdoo, president of the Hudson & Manhattan Railroad Company, in a speech before the City Club on Dec. 3 warmly indorsed the plans of the Public Service Commission relative to the so-called "tri-borough" scheme. He approved of the increase in size of the tunnel, which he estimated would cost $10,000,000 and save $1,200,000 in operating expense.

In a letter to Chairman Willcox, of the Public Service Commission, dated Dec. 3, Mr. McAdoo stated that his offer to operate the subways to be built by the city would be withdrawn if not accepted on or before Dec. 15.

Mr. Sprague, in commenting upon the speech and letter of Mr. McAdoo, said that the route proposed by Mr. McAdoo is not the so-called "tri-borough" route, but is made up of the best of the tri-borough elements and other new and more valuable routes not forming any part of the original tri-borough system. Mr. Sprague stated that if the city will abandon its demands of a guarantee of the interest and sinking fund against the cost of construction and permit private capital to have prior lien on the net earnings, and state that competitive bids will be accepted under seal at a specified date, he will guarantee that a better proposal than that of Mr. McAdoo will be made either for the line which Mr. McAdoo has proposed or for a better alternative route.

On Dec. 5 the Interborough Rapid Transit Company submitted to the Public Service Commission a proposal covering the construction and operation of certain subway extensions in Greater New York. The company offered to pay $75,000,000 of the total cost of $128,000,000 for the extensions. Of the net profits from operation the city is to take all for the first five years from the beginning of operation, after which the net profits are to be divided equally between the city and the company. The company proposes a 5-cent fare over the entire system.

Success in Electrical Engineering.

At a meeting of the New York branch of the National Electric Light Association, held on Nov. 10, Dr. C. P. Steinmetz delivered an address in which he outlined the requirements for success in the field of electrical engineering. In commenting upon the complaint of scarcity of opportunities at the present time Dr. Steinmetz said that there are now opportunities which did not exist before. There is a demand for good successful men and there is a very limited supply when it comes to those positions which command a high-salaried man, say between $4,000 and $10,000 a year. The prime requisite for success is knowledge, both theoretical and practical. It is not sufficient to have either practical experience or theoretical knowledge, but the two must be combined. The practical man is always limited to those spheres of work in which he has had previous experience. When anything comes up beyond what he has met before he necessarily must fail. On the other hand, theoretical knowledge alone is valueless. College graduates who have studied reasonably hard and have acquired a great amount of theoretical knowledge, but have no practical experience as they come from college, are useless. They have first to gain the practical experience, and the success they make depends entirely on their ability to gain this practical experience.

The acquiring of sufficient theoretical knowledge by the man of practical experience does not mean necessarily a college education. However, the college is the place specially devised for gaining this knowledge. The four years spent there acquiring knowledge is time well spent, for it is difficult to get at any other place an equal amount of theoretical knowledge in so short a time. Not all students receive benefit from the instructional staff who feed the knowledge to them. The students do not properly appreciate the knowledge and do not profit by it to the same extent as do men who have gained their theoretical knowledge by practice and by studying alone.

A person studying alone to gain knowledge should guard against wasting his time and effort in the details of the vast field covered by the industry; he should select topics that will broaden his knowledge. The man who works without the assistance of others is liable rather to be side-tracked; he works very hard, but seldom accomplishes anything that counts.

The successful electrical engineer must know a great deal about not only electrical engineering but everything else as well. It is difficult in an electrical engineering college to make the boys study subjects not connected with electrical engineering. They may be willing to study all phases of electrical engineering, but they cannot realize why they should know history, chemistry, literature or anything else that is not electrical.

The college graduate who has only theoretical knowledege makes a failure because he lacks common sense, which, after all, is nothing but the intuitive and instinctive judgment based on very broad experience and knowledge. Those men who have succeeded, who are esteemed by the world as great, are interested in everything, and they have succeeded because of the universal interest and broad view which they take. They have the common sense which makes them successful in applying their knowledge in chemistry or electricity or whatever it may be.

In commenting upon the education given by the college and the education acquired by a practical man Dr. Steinmetz said that the only field in which the college is superior is mathematics. It is desirable to have a systematic course in mathematics, such as is afforded by the college. Some college men may gain nothing from it, but those who really understand it have an advantage which is very hard for a practical man to overcome. Mathematics is very desirable, and it is absolutely necessary in calculating in some branches of medium-high electrical engineering, but it is not quite essential in all the highest fields of electrical engineering. The assistant designer of apparatus must have a knowledge of mathematics, but the chief engineer who directs the designer need not have such a great knowledge of mathematics. He must understand why things are so and why they are not so; he should know how things are done, but he can hire an assistant to do the calculating. It is more difficult to understand electrical phenomena without mathematical training, but it is not impossible to do so, and one need not be discouraged because he is not a mathematician.

City Electric Railways and Their Relations to the Public.

In a luncheon talk before the Chicago Engineers' Club, Nov. 30, Mr. Charles V. Weston, president of the South Side Rapid Transit Company, of Chicago, discussed the relations of the public with surface and elevated electric railways in cities. For comparison he described intramural transportation twenty-five years ago, when slow, dirty horse cars were in use, and contrasted these with the present high-speed, sanitary, well-lighted electric cars in which the same 5-cent piece purchases a ride. Meanwhile the costs of labor, materials, supplies, etc., have risen more than one-third, the lines have been extended for miles into suburban areas, involving longer hauls, and the equipment has grown heavier, necessitating more expensive apparatus throughout the system.

In all of this the citizen has been the gainer, being enabled to live at a greater distance from the center of employment amid more pleasing and healthful surroundings, while his time of travel to and fro has been greatly diminished. Indeed, said Mr. Weston, if each of the 10,000,000,000 people who rode on the street-car systems of the country during a single year has saved ten minutes each ride at an equivalent wage of 15 cents per hour, the economic saving would be $238,000,000; more than 2.5 times the entire income of the companies carrying this traffic. The average haul in Chicago is six miles per passenger for the elevated roads, and slightly less for the surface lines. No other expenditure of a nickel commands such vital and full service as does the city street-car ride, bringing the place of employment of tens of thousands of people close to their homes in the suburbs and outlying sections of the city. Mr. Weston recited the results of the Boston investigation of the division of a 5-cent car fare, and declared that approximately the same proportion would hold in any large city in America.

As proof of the extending influence of electric railways on the distribution of Chicago's population Mr. Weston cited the assessor's figures for the valuation of property in the Hyde Park section of the city during certain years. In the year of the cable-car system, 1882, this figure was $7,580,000; in 1890, $16,000,000; in 1900, $26,000,000, and in 1909, $78,611,000. This particular region has always had steam suburban-railway service, but it was the coming of the electric lines which contributed to its growth so enormously, as the dates show. The electric railways are cutting into the steam roads' traffic, for the former, both surface and elevated lines, offer more frequent service at relatively high speeds for short distances and deliver passengers virtually at the doors of their places of employment. Where the old horse-car speed sometimes reached four and one-half miles an hour, the modern elevated cars average twenty miles an hour in express service.

The elevated railways of Chicago represent an investment of $100,000,000 and the surface lines $107,000,000. Thus the industry locally means a physical property of more than $200,000,000, with its accompanying enormous redistributing power in the salaries of thousands of employees and in the large amounts spent for maintenance and renewals. This beneficent aspect of electric railways in promoting business prosperity is in addition to their important services in opening up vast suburban areas for habitation by city people, who are served with rapid, comfortable rides at minimum cost.

Mr. Weston spoke of the sometimes unpleasant attitude in which the public views corporation affairs, while the capitalists look upon electric railway investments as hazardous in view of the diminishing returns on capital caused by the rise of the prices of labor and material. The solution of this acute situation, he said, lies with the people in the granting of franchises which shall be fair to both themselves and the companies. Modern economists admit the natural monopolistic nature of street-railway service, most of them agreeing that such service can be more economically rendered on a non-competing basis, but under legalized control and regulation. Mr. Weston, therefore, advocated the granting of franchises in which the passenger rate should not be stipulated as in the past, but instead the capital invested should be assured a fair return, the fare being adjusted as the varying conditions of length of haul and density of population require. The return on the investment should be made proportional also to the hazard involved. Where service is demanded in sparsely populated districts part of the cost of building the lines should be assessed against the region benefited, as is already being done in New York State.

Such a franchise, assuring to investors a reasonable return on their capital, would not only react to render electric railway and public-service corporation securities more stable and secure, but would benefit the employees, providing them with more adequate remuneration and working conditions, and, in the end, the general public, through maintaining and operating the property at its highest efficiency, keeping its equipment apace with the art. By placing before the public the exact truth about the cost of operation its co-operation could be secured in the granting of fair franchises. Mr. Weston does not believe in the municipality sharing the profits of operation, declaring that adequate service for patrons is all that should be expected or asked from public-service companies. The problem of franchises will soon again be presented to Chicago, said the speaker, and the present surface-railway rehabilitation ordinances are but a step in the right direction.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has issued an order on the petition of the Foxboro Electric Company for an issue of additional capital stock of the par value of $43,500 to enable it to acquire a power station building, pond, land and equipment from the Standard Gage Manufacturing Company. The company has recently enlarged its business to include the generation and selling of steam and hot water. The company will issue 335 shares of additional stock at $100 each, the board's order reducing the amount asked by 100 shares. The company has connected its lines to the new station and is giving twenty-four-hour service. The old station is to be dismantled. The board has issued an order authorizing the Norfolk & Bristol Gas & Electric Company to issue addi-

tional capital at $100 per share to the amount of $25,000 to enable the company to acquire an oil gas plant from the Standard Gage Manufacturing Company. The Weymouth Light & Power Company has petitioned the board for authority to issue additional capital stock to the amount of $210,000 to provide for the extension and improvement of its plant and system, and the Greenfield Gas Light Company has petitioned for the right to issue new stock to the amount of $50,000 at the par value of $50 per share to pay the cost of enlargements of its plant. The Tyngsboro Electric Company has requested permission to issue new stock of the par value of $7,500 to enable it to establish the supply of electricity in the town.

The Massachusetts Railroad Commission has issued two decisions sustaining the companies in the petitions of the Selectmen of Revere for fare reductions on the lines of the Boston Elevated Railway Company and the Boston & Northern Street Railway Company.

The commission gave a final hearing on Dec. 2 upon the appeal of the Boston Elevated Railway Company from the refusal of the Cambridge Water Board to approve the company's plans for pipe location in a section of Massachusetts Avenue. Each party submitted a plan of the pipe location it desires in connection with the construction of the Cambridge subway. The company contended that the city's plan would expose it to an expense of about $40,000 for the taking of property, while the city argued that under the company's plan the pipes would not be laid deep enough to avoid danger from freezing. The board took the case under advisement.

The Railroad Commission has authorized the Berkshire Street Railway Company to carry baggage and freight in the Town of Egremont.

Maryland Commission News.

The matter of testing and approving electric meters was considered last week by the Maryland Public Utilities Commission. Hereafter this task, along with that of testing the quality and purity of gas, will be done under the supervision of Mr. Charles E. Phelps, the commission's chief engineer. Heretofore Lighting Superintendent McCuen has looked after the lighting tests as a part of his official duties, but the Public Service Commission law requires that the commission shall do this work. Use of electric meters will not be permitted anywhere in Maryland until the commission shall have first made its tests and placed upon the meter the seal of its approval. These tests will be made at the plants of the lighting companies throughout the State before the meters are installed and on the premises where they are being used after installation if there is any reason to believe that they are not working properly. Tests are already being made by Mr. Phelps of the quality and purity of gas, and arrangements have been made with Mr. McCuen whereby the State is to have the use of the city's apparatus and the testing-room in the City Hall at Baltimore, which is especially equipped for such purpose. This plant has only recently been installed under the authority of an ordinance of the City Council. After a lapse of a few months, during which time the commission is expected to complete its plans, the plant will probably be installed in the old Builders' Exchange Building, where the commission now has its offices, and tests will be continued there.

Members of the Old Frederick Road Improvement Association appeared before the Public Service Commission last week and urged better street railway facilities for Ellicott City and Catonsville. They asked that the United Railways & Electric Company be required to continue its Frederick Road line from its present terminus at Stoddard's over the cut-off to the Ellicott City line. A number of transfer privileges were also asked for. The charge was made that the residents of Ellicott City are discriminated against by the railway company in addition to being made to pay an excessive fare for transportation. The commission is holding the entire matter under advisement.

AMERICAN ELECTRICAL ENGINEERS.—XXII.

Rudolph E. Hellmund.

Rudolph Emil Hellmund was born Feb. 2, 1879, in Gotha, Germany, where he received his primary education. Prior to taking up technical studies and in order to gain some practical experience he spent a year as an apprentice in a factory at Gotha. His technical education was principally received at the Technical High School of Charlottenburg, Germany.

Mr. Hellmund's first professional position was with the Sächsische Elektricitätswerke, formerly Poeschmann & Company, in Heidenau-Dresden, Germany, as assistant to Mr. Julius Heubach, well known as the author of a book on alternating-current motors. His work there consisted chiefly in the mechanical design of alternating-current and direct-current machinery. Following this engagement he spent a year in the laboratories of the Land-und-Seekabelwerke Company, Cologne-Nippes, Germany, where he was chiefly occupied in investigations of cables, especially for high-voltage work, the company then being engaged in manufacturing its first cables for 20,000 volts, which were tested to 100,000 volts. Two and a half years were then spent in the electrical division of the Maschinenfabrik

Rudolph E. Hellmund.

Esslingen Company, at Cannstatt, Germany, which were occupied in various ways, including the design of direct-current and alternating-current machinery, transformers and control apparatus and in expert service on trouble work, in which latter capacity a wide experience in field work was gained. During the last year at Cannstatt he was in charge of the testing department and also in supervisory charge of the generating station supplying electrical energy to the factory and to the tramways of Cannstatt.

In August, 1903, Mr. Hellmund came to the United States, originally with the intention of spending only a short time here. After traveling for several months throughout the country, however, he remained in New York, where a year was spent in consulting work of various kinds, such as the design of telegraph apparatus in connection with a system for transmitting drawings, the design of electrochemical apparatus to be used in the manufacture of camphor, and the design of circuit-breakers, switchboards and some other appliances. About the end of 1904 he accepted a position as assistant to Mr. William Stanley in Great Barrington, Mass., and was chiefly engaged in work in

connection with the design and test of the Stanley self-compounding alternator and its low-frequency exciter. In June, 1905, he became connected with the Western Electric Company, which was then taking up the manufacture of alternating-current apparatus. After assisting in an investigation of the patent situation he was put in responsible charge of all the alternating-current motor designing of the company and developed its lines of induction motors, as well as a line of synchronous motors.

In October, 1907, Mr. Hellmund accepted a position in the engineering department of the Westinghouse Electric & Manufacturing Company and received charge of the development of several new lines of induction motors for mill work and for crane, hoist and elevator service. Since October, 1909, he has been engaged in organizing and is now in charge of the section of the engineering department which has cognizance of all estimating work for electric power apparatus. He also acts in a consulting capacity in connection with three-phase railway and industrial projects.

To Mr. Hellmund have been granted a number of electrical patents in this country and abroad relating to circuit-breakers, oil switches, fuses, induction motors, etc. He has contributed largely to the technical press, both in Europe and this country, especially to the *Eclairage Electrique*, of Paris, the *Elektrotechnische Zeitschrift*, of Berlin, and the columns of this journal. The subjects cover a very wide range, including the theory and design of synchronous and induction motors, commutation, graphical treatment of higher harmonics, the rotating field, polyphase windings, etc. He has contributed two papers to the *Transactions* of the American Institute of Electrical Engineers, entitled, "Zig-Zag Leakage" and "Graphical Treatment of the Rotating Field," and a paper on "Graphical Treatment of the Zig-Zag and Slot Leakage in Induction Motors" to the British Institution of Electrical Engineers.

Mr. Hellmund is a member of the American Institute of Electrical Engineers, the Verband Deutscher Electro-Techniker and the Deutsch-Amerikanischer Technikverband.

CURRENT NEWS AND NOTES

Meter Tests.—Of 8098 tests of watt-hour meters made during October by the New York Public Service Commission for the Second District 379, or 4.68 per cent, were fast; 6534, or 80.69 per cent, were accurate, and 1185, or 14.63 per cent, were slow.

Public-Utility Regulation in District of Columbia.—President Taft in his recent message to Congress recommended laws for the regulation of public utilities in the District of Columbia similar to those upon which the Public Service Commissions of New York and Massachusetts are based.

Break-Down Electric Service in New York City.—In New York City 25 per cent, or 185, of the isolated plants have a break-down connection with the mains of the Edison company. The minimum guarantee made by the break-down customers last year was $111,510 and the actual break-down revenue was $158,000.

Physics Department at Urbana.—On Nov. 19 the physics department of the University of Illinois gave the general public a special invitation to inspect its new building and to see the various laboratories in operation. In the evening all departments were in operation and members of the instructional staff were on hand in each room to explain the work done there. The guest of honor was Prof. A. A. Michelson, head of the department of physics at the University of Chicago.

Gasoline-Lighting Contract in Chicago.—On Nov. 14 the City Council of Chicago authorized the city electrician to enter into a contract with the American Development Company for furnishing and maintaining about 7000 60-cp gasoline street lamps in Chicago during the period from Sept. 1, 1910, to Aug. 31, 1911. The amount to be paid the company is not to exceed $2.20 a month for each of the lamps. The lamps, which are used on outlying streets where the electric or gas mains are not extended at the present time, are to be placed at locations designated by the city electrician. Deductions are to be made from the rated price for unsatisfactory service.

Conspicuously Colored Street Cars Suggested to Prevent Accidents.—Commenting on the fact that eight persons were killed and 284 injured in street-railway accidents in Chicago in November the city attorney says that ordinary care exercised by the public in crossing streets or in getting on or off of cars would reduce the number of accidents greatly. He suggests that the front of each street car be painted a bright yellow, instead of dark green, to make it more conspicuous.

I. E. S. Meeting in New York.—The New York Section of the Illuminating Engineering Society will hold a meeting in the Engineering Societies Building on Dec. 8 at 8:15 p. m. A paper entitled *The Early History of Photometric Standards*, by Prof. Edward L. Nichols, will be presented in abstract. Mr. Bassett Jones, Jr., will present an extensively illustrated paper entited *The Lighting of the Allegheny County Soldiers' Memorial Building in Pittsburgh.* This paper will treat of what is probably the most elaborately lighted building thus far erected, in which practically all forms of electric illuminants have been used in unique ways.

Lewis Institute A. I. E. E. Branch.—At a recent meeting of the Lewis Institute Branch (Chicago) of the American Institute of Electrical Engineers Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, delivered an illustrated lecture on the "Generation of Electricity in the Largest Steam-Turbine Station in the World." Mr. Abbott showed the marked economy in space effected by the use of steam turbines, and spoke of the handling of the enormous amounts of coal passing through a large station like that of the Commonwealth Edison Company at Fisk Street, and also gave the efficiencies of the various agencies used in transforming the potential energy of the coal into electricity.

Corporation Tax.—The Chicago *Daily Tribune* of Nov. 27 gives some information in relation to the payments made under the special corporation tax by a few selected corporations. The corporations gave the information required by the new law, under oath of their officers, for the year ended Dec. 31, 1909. Upon the basis of these statements the government assessed a special excise tax of 1 per cent upon the net income. Each corporation then paid the assessed tax, but a formal protest accompanied the return, because the constitutionality of the law is being contested in the courts. Among the corporations mentioned by the *Tribune* are the People's Gas Light & Coke Company, which paid a tax of $32,129; Commonwealth Edison Company, $22,987, and Chicago Telephone Company, $21,866.

A. I. E. E. Meetings.—At a meeting of the American Institute of Electrical Engineers to be held in the Engineering Societies Building, New York, on Dec. 9 Messrs. E. D. Dickinson and L. T. Robinson, of Schenectady, N. Y., will present a paper entitled *Testing of Steam Turbines and Steam Turbo-Generators.* On Dec. 8, at the same place, a paper entitled *Industrial Continuation Schools of Munich* will be presented by Dr. Georg Kerchensteiner, Superintendent of Schools of Munich, Bavaria. This meeting will be under the joint auspices of the National Society for the Promotion of Industrial Education, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers. A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on Jan. 11, at which time a paper on *Corona* will be presented by Prof. Harris J. Ryan, of Stanford University, California.

Montreal Abolishes Gas Street-Lighting.—The superintendent of the Montreal city lighting department has announced that after Dec. 31 all street gas lamps will be superseded by tungstens, which latter will give twice the illumination at less cost per lamp.

Winnipeg Electric Railway Company Must Remove Transmission Line City Poles.—The Winnipeg Court of Appeals has decided that the Winnipeg Electric Street Railway Company has not the right to erect poles or wires in the City of Winnipeg for the transmission of electrical energy for any purpose other than for its electric railway.

Consolidation of Telephone Journals.—Our contemporary *Telephony*, of Chicago, announces the consolidation with it of the *Telephone Weekly* and *Telephone Securities Weekly*, both heretofore published in New York. Other journals previously absorbed by *Telephony* were the *American Telephone Journal, Sound Waves, Telephone Magazine* and *The Telephone*.

Transmission Line Tested at 250,000 Volts.—A test was made on Dec. 3 at London, Ont., at 250,000 volts of the transmission line of the Canadian Hydroelectric Commission between London, Ont., and Niagara Falls. The test is stated to have been very satisfactory, and the chairman of the commission, Hon. Adam Beck, stated that regular electric power transmission to London and Berlin would begin at once.

Wireless on Austrian Ships Compulsory.—The Austrian Ministry of Commerce has ordered all Austrian merchant vessels carrying passengers from Austrian ports to places beyond Gibraltar and the Suez Canal to be equipped with wireless apparatus at a minimum range of 100 miles and capable of communicating with ships and coast stations. Austria is the first country to adopt such a compulsory measure.

Pittsburgh A. I. E. E. Meeting.—The Pittsburg Section of the A. I. E. E. held a meeting Nov. 16, 1910, in the auditorium of the Engineers' Society at which papers were presented on *Mine Locomotives*, by Mr. G. M. Eaton, and on *Hoisting* by Mr. W. Sykes. Messrs. E. C. Wayne, H. L. Beach, L. C. Illsley, W. W. Miller, C. N. Van Slyke and W. A. Thomas participated in the discussion. The attendance at the meeting was about ninety.

Better Bridge Lighting Demanded in Chicago.—Resolutions have been adopted by the Cook County Real Estate Board urging that the bridges spanning the Chicago River and its branches be lighted better. The demand is made not only on the ground of greater safety to pedestrians and vehicular traffic, but because the lighting will add to the attractiveness of the city at night, while the lamps and their supports may be a material aid in the beautifying of the city.

Telegram and Foreign Letter Service.—The Western Union Telegraph Company has arranged a service whereby it will mail telegrams received at New York and addressed to a correspondent abroad. Such a letter will be received by the telegraph company precisely as a message would be received, transmitted at the usual tolls, and the copy at New York placed in a special sealed envelope, addressed as directed, and rushed to any available steamship. The only extra charge will be 5 cents for postage.

Large-Scale Use of Electricity in Farming.—According to reports from Helena extensive use will be made of electricity in farming throughout Sweet Grass County, Mont., on that large portion of it reclaimed by a local land company under the provisions of the Carey act. It is estimated that 2000 hp can be developed on Big Timber and Otter Creeks. The electricity thus produced will be used on the farms for lighting, heating, cooking, pumping, running cream separators and fanning mills, elevating hay and, in fact, almost anything to which the hand may be turned to advantage.

Institute of Industrial Research.—The Institute of Industrial Research has been formed at Washington to undertake the investigation of industrial problems. At first the work will be largely confined to metallurgical problems with especial reference to the protection and conservation of industrial metals; agricultural chemistry, including land and fertilizer problems; hydraulic cement; paint technology; electrochemistry and chemical engineering; road building and paving. Mr. A. S. Cushman, formerly with the Agricultural Department and well known for his investigations into the corrosion of steel fence wire, is director of the institute. Dr. N. Munroe Hopkins will have charge of the division of electrical engineering and electrochemistry.

Franklin Institute Elliott Cresson Gold Medals.—The Franklin Institute has conferred the Elliott Cresson gold medal, the highest award in the gift of the Institute, on the following gentlemen: Dr. Edward Weston, Sir J. J. Thomson, Mr. John Fritz, Prof. Ernest Rutherford, of the McGill University; Sir Robert A. Hadfield, the metallurgist; Dr. Harvey W. Wiley, of the Department of Agriculture, and Prof. John A. Brashear, maker of astronomical instruments. The medal was awarded to Dr. Weston for distinguished leading and directive work in electrical discovery and in the advancement of electrical application. The award to Prof. Thomson was on the grounds of distinguished work in the advancement of the knowledge of physical sciences, and that to Prof. Rutherford for his work in radioactivity.

Electromagnets for Recovering Torpedoes.—The Navy Department is planning to experiment with electric lifting magnets for recovering torpedoes which are fired in practice and which, through some fault of the controlling mechanism, go to the bottom after their energy is expended. These torpedoes are virtually small submarine vessels with self-contained power plant, steering mechanism, etc., and each one is worth a small private fortune. The points where they are lost will be marked by buoys and magnets then dropped down to grapple them and bring them to the surface. Owing to the buoyancy of the water magnets of relatively small lifting power may be used, but it will be important that these be constructed to withstand the severe conditions of moisture and temperature changes under which they will be operated. Electromagnets were recently used in a similar manner for recovering kegs of nails from a sunken barge in the Mississippi River, and this achievement suggested the new use of the magnets to the naval engineers.

Electrochemical Society Meeting.—The New York Section of the American Electrochemical Society will hold the first meeting of the season at the Chemists' Club, 108 West Fifty-fifth Street, on Dec. 16, 8:15 p. m. The program of the evening will be as follows: The meeting will be opened by a paper by Dr. E. F. Roeber. This paper will treat of the fixation of nitrogen and include a statement of the three principal commercial processes now in operation, and also introductory remarks regarding some later developments and the later uses that have been proposed for the products. It is expected that Mr. Charles S. Bradley, the pioneer of the industry in this country, will be present to participate in the proceedings. The Birkeland-Eyde and the Badische Company and Pauling processes will be represented, and the manufacture of cyanamide will also come under discussion. In conclusion Mr. John C. Clancy will present a paper on a very interesting modification of the cyanide process, employing cyanamide instead of cyanide in the treatment of gold and other ores. This method is of great interest to both metallurgists and electrochemists, as the process involves the use of electrolysis as a fundamental portion thereof.

Netherlands Patents.—The parliament of the Netherlands has adopted a bill granting State protection to foreign patents on payment of a small fee. Previously foreign inventions were not protected.

Winnipeg Municipal Hydroelectric Plant.—It is expected that the hydroelectric plant being erected by the City of Winnipeg at Point du Bois, Winnipeg River, Manitoba, will transmit energy to that city early next spring. The plant is seventy-miles distant from Winnipeg and will cost $3,500,000. There is available at Point du Bois 100,000 hp, of which 20,000 hp is now under development. A dam on the Winnipeg River creates a storage reservoir of 6000 acres.

Proposed Hydroelectric Commission for Alberta.—At a recent meeting of the City Council of Edmonton a resolution was passed asking the provincial government to develop and take under its control the water-power resources of the Province of Alberta, to be used for the benefit of the municipalities. The resolution was suggested by the work of the Ontario Hydroelectric Commission, which has operated in the Niagara peninsula for the benefit and advantage of the municipalities forming the union for the purpose of utilizing Niagara power. It is proposed that the question be brought to the attention of the different municipalities throughout the Province of Alberta, with a view to obtaining co-operation in an effort to induce the Alberta government to sanction and carry out the undertaking.

Shafts and Deep Tunnels for Underground Cables.—For carrying the electric cables and steam-heating pipes to the various buildings on the campus of the University of Minnesota, at Minneapolis, advantage has been taken of the peculiar geological strata to avoid expensive excavation. The new heating plant, which will also be the substation for the transmission line conveying hydroelectric energy from the federal plant at Fort Snelling, near by, is being erected on the river bank at the base of a 100-ft. cliff, on the top of which sit the university buildings and campus. For 90 ft. below the campus level this cliff is of solid, hard limestone, but is underlaid by a thin stratum of half-formed sandstone so loosely packed as to be easily excavated with a spade. From the heating plant tunnels are being constructed through this soft sandstone to points under the various campus buildings, from which vertical concreted shafts excavated through the limestone superstrata will be used to convey the cables and pipes to the buildings above.

British Columbia 65,000-hp Proposed Hydroelectric Development.—The International Electrical Company, Limited, with offices in Nelson, B. C., and Portland, Ore., has filed plans for the development of a large electric-power plant from the falls on the Pend d'Oreille River. The river runs from Canada to the United States, some fifty miles southwest of Creston, B. C., and for nine miles before reaching the boundary it is a series of rapids. At a point some six miles above, on the Canadian side, a site admirably adapted for the necessary development works has been staked, and it is expected that a city will be located in the vicinity, to be known as Falls City. Mr. W. E. Moore, hydraulic engineer, of Spokane, has made an investigation and report on the power sites of the river, in which it is stated that the upper site is capable of a total development of 65,000 hp, and that the cost will be about $60 per horse-power. The Sheep Creek and Ymir mining districts are only fifteen miles away, and the power sites are within 100 miles of Spokane.

Federal Dam in Mississippi River Near Minneapolis.—The 30-ft. dam which the federal government is planning to build in the Mississippi River near Fort Snelling, between Minneapolis and St. Paul, Minn., will make navigation possible up to Minneapolis and will create a water-power averaging 15,000 hp throughout the year. Hydroelectric energy thus developed will be used for lighting Fort Snelling and the Soldiers' Home near by, besides furnishing 3000 hp to the University of Minnesota, about three miles distant. The remainder of the electrical output of the station it has been proposed to utilize for public and park lighting in Minneapolis and St. Paul, although at the low stages of the river only 5000 kw will be available in all. The present year has marked the lowest river stage of any season since 1863, and all of the water-power plants in Minnesota have felt the effect of the low water. The United States government will build the dam at Fort Snelling, but the federal right to operate a hydroelectric generating station selling energy to state and municipal bodies has been questioned.

Eastern New York N. E. L. A. Section.—Although the territory of the newly organized Eastern New York Section of the National Electric Light Association has not yet been closely defined by the national committee, it is probable that the section of New York State between Poughkeepsie and Syracuse will be included with Plattsburg as the northern limit. Being the geographical center of the territory covered and the home of the General Electric Company, with so many men prominent in the commercial phase of the electrical industry, Schenectady was a logical choice as headquarters. The first general meeting of the season will be held at Schenectady on Dec. 13, at which President W. W. Freeman and Executive Secretary T. Commerford Martin will make addresses. The section has already 140 members and the membership committee, of which Mr. W. E. Brown, of Schenectady, is chairman, is making an active campaign among the central-station men in the large and thriving towns and cities of eastern New York. The officers of the new section are as follows: President, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany; vice-president, Mr. M. O. Troy, General Electric Company, Schenectady; treasurer, Mr. T. A. Kenney, Hudson River Electric Power Company, Albany; secretary, Mr. R. H. Carlton, General Electric Company, Schenectady. The executive committee is composed of the following members: Chairman, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany; Mr. C. D. Haskins, General Electric Company, Schenectady; Mr. M. Webb Offutt, Schenectady Illuminating Company, Schenectady (Mohawk Gas Company, Schenectady); Mr. A. A. Anderson, Albany Illuminating Company, Albany; Mr. J. C. DeLong, Syracuse Lighting Company, Syracuse; Mr. F. H. Gale, General Electric Company, Schenectady.

Johns Hopkins Lectures for Electric Light Men.—The first of a series of ten lectures arranged by the Consolidated Gas, Electric Light & Power Company, of Baltimore, for its employees was given on Nov. 29 at the Johns Hopkins University of Baltimore. Upon the initiative of the Baltimore Consolidated Section, N. E. L. A., the company has made arrangements to offer to its employees opportunities for scientific training. The entire expense of the course of lectures to be given this winter is borne by the company and the lectures are open to all of its employees. The ten lectures will be given on alternate Tuesday evenings by Dr. John B. Whitehead, professor of applied electricity at the Johns Hopkins University. From 1893 to 1896 Dr. Whitehead was designing engineer for the Westinghouse Electric & Manufacturing Company. During 1896 and 1897 he was operating engineer of the Niagara Falls Power Company. In 1899-1900 he was electrical engineer of the Rowland Telegraphic Company. From 1903 to 1905 he was research fellow of the Carnegie Institution. From 1906 to 1908 he was electrical engineer of the Baltimore & Annapolis Short Line. Perhaps the most important engineering work which he has done is the electrification of the Baltimore & Annapolis Short Line, which was designed by him and installed under his supervision. When the course of lectures was inaugurated Dr. Whitehead was introduced by Mr. Herbert A. Wagner, director of the electrical division of the Baltimore company, who outlined the purposes of the course of lectures and the opportunities offered by it. On the Tuesday evenings intervening between Dr. Whitehead's lectures meetings will be held of the Baltimore Consolidated Section, N. E. L. A., and addresses will be made by men connected with various departments of the Baltimore company and by men from companies in other cities.

SWEDISH GENERATING STATION.

The Extension of the Municipal Steam Electric Power Station of Stockholm.

By E. Andreason.

THE municipal electricity work of Stockholm, the capital of Sweden, dates from the year 1892, when the so-called Brunkeberg station was erected. This steam-driven, direct-current station supplied energy at 2 × 110 volts pressure to a limited part of the city, the business district. In order to meet the demand it has been gradually extended to its present equipment of about 1350 kw in generators, working together with a storage battery of 10,000 amp-hours rating. In the year 1903 a large addition to the equipment was installed. The underground direct-current distribution network was extended to all of the districts of the town. The old system with steam-driven, direct-current stations not being considered economical, a three-phase, steam-driven station was erected at the Värta harbor, the energy therefrom being transmitted by means of underground cables to substations in the different districts of the town. The site of the Värta power station may be seen from the map in Fig. 2. The Värta harbor is located at a distance of about 3 km (1.8 miles) from the center of the city. The site of the power station is, therefore, favorable for coal and water supply. The Värta station generates three-phase current at a pressure of 6000 volts and 25 cycles. At first three 1500-kw, triple-expansion, engine-driven generators, running at a speed of 100 r.p.m., were installed. In the year 1907 two turbo-generators of the same rating and with a speed of 1500 r.p.m. were erected. The large extension which is to be described in this article was erected in the year 1909, containing two turbo-generators, each of 6000 kw rating, with boilers, economizers, switchgear, etc. At the same time the old coal-handling plant was altered and enlarged. A good idea of the development of the load on the stations of Stockholm is given by the curves on Figs. 3 and 4.

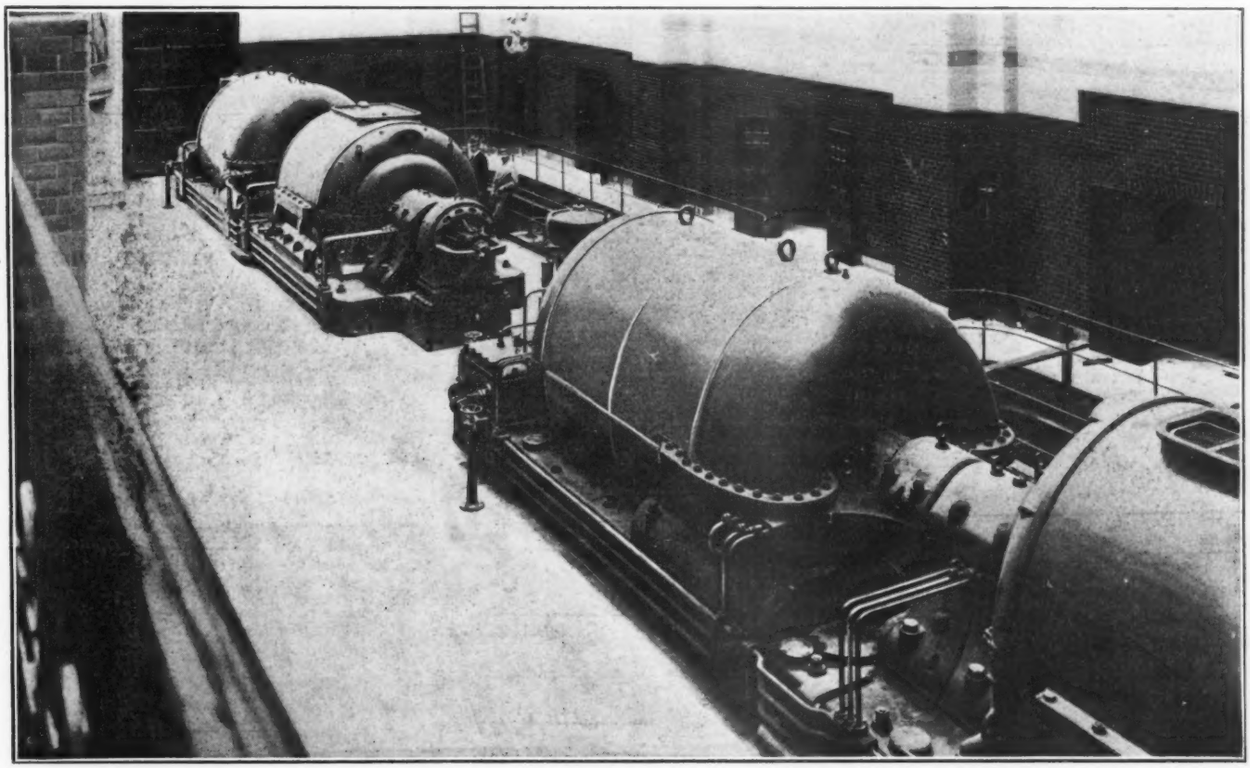


Fig. 1—Interior of Generating Station.

COAL-HANDLING PLANT.

The coal is unloaded from the ships by means of two electric cranes which can be moved along the quay wall, as seen in Fig. 5. The grabs of the cranes discharge the coal into a hopper fixed to the framework of the crane, from where it is dropped into cable-way cars which carry the coal to the coal yard located behind the power station, as indicated in Fig. 7. Each cable-way car takes 35 cu. ft. of coal, and the total number of cars is 86. The cable-way is guaranteed to be able to transport 110 tons of coal per hour. The coal yard, which is shown in Fig. 7, has a length of 340 m (1100 ft.) and a breadth of 35 m (115 ft.). The cable-way cars tip the coal on both sides of the yard. From there it is taken by an electric crane which runs on elevated rails in the middle of the coal yard. The grab of this crane unloads the coal into a large hopper running on the same rails. When the hopper is filled it is pushed by the crane to a funnel-shaped hole in the coal yard, into which it is tipped. Through this funnel the coal is carried to the crushers placed below the floor of the yard. The crushers deliver it on two inclined belt conveyors which unload it into automatic weighing apparatus placed under the roof of the boiler house. From here the coal is delivered to the horizontal belt conveyors, from which it is thrown off into the bunkers placed below for that purpose. All of the apparatus of the coal-handling plant is driven by direct-current motors which have a total rating amounting to 350 hp.

GENERAL ARRANGEMENT OF THE EXTENSION.

A plan view of the old power house, the 1909 extension and a possible future extension is shown in Fig. 8. This illustration shows the power house equipped with six turbo-generators of the same size as those recently installed. The new extension is a continuation of the old power house. The new machine-room is, however, considerably narrower than the old one by reason of the fact that the new turbo-generators are placed lengthwise in the machine-room, the width of which is only 14 m (46 ft.). This way of placing the turbo-generators gives also a better general arrangement, the space occupied by each turbo-generator lengthwise in the machine-room being practically the same as that taken in the boiler-room by the four boilers belonging to this turbine. The machine-room is spanned by a 40-ton electric crane. The condensers with auxiliaries are located in the cellar below the machine-room. In order to secure daylight in this cellar and to

make the apparatus placed in it accessible for the traveling crane of the machine-room large openings are made in the machine-room floor. Below this cellar are located the main circulating-water tunnels and also a cooling-air tunnel for the ventilation of the generators. Along the outer side of the machine-room there is a five-story building with a width of 8.5 m (29 ft.), the three upper stories of which contain the high-tension switchgear. The building along the outer side of the boiler-room accommodates the economizers, feed-water heater, feed pumps, etc. The extension is arranged according to the so-called individual system so that each group of one turbo-generator with the boilers, economizers and switchgear belonging to it may be run independently of the rest of the system.

BOILERS.

The arrangement of the boilers is shown by Figs. 8 and 11. For each 6000-kw turbine there are four Babcock & Wilcox boilers placed in two rows with a wide firing floor between them.

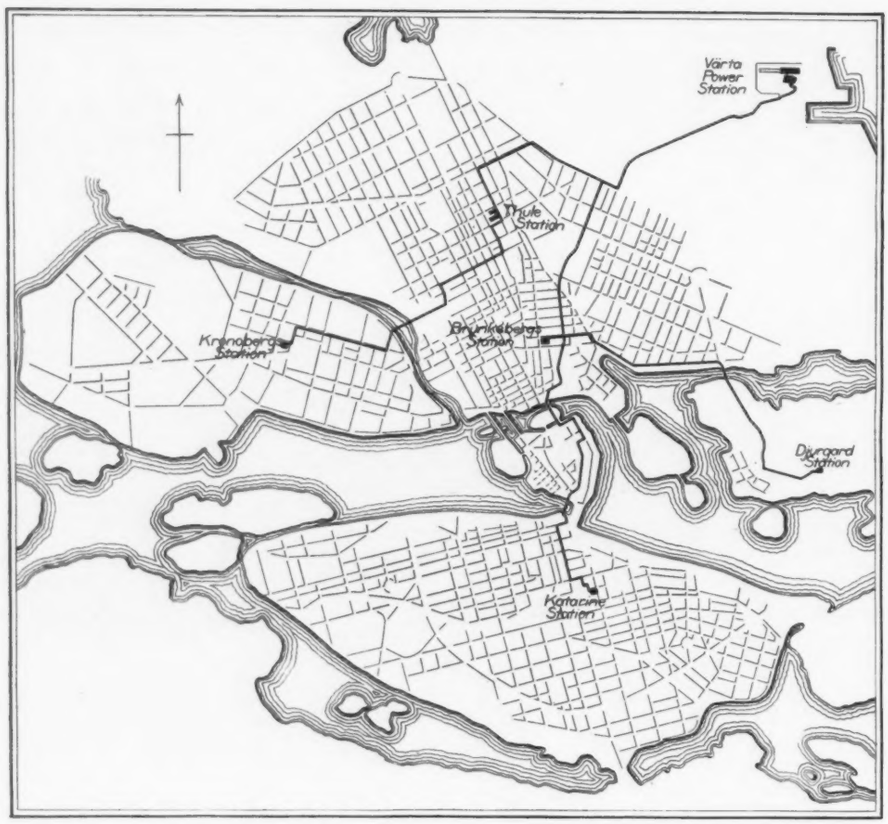


Fig. 2—Map of Stockholm, Sweden, Showing Location of Power Station and Substations and High-Tension Network.

The heating surface of each boiler is 550 sq. m (5900 sq. ft.). The boilers are equipped with B. & W. chain grate stokers, each having a grate area of 13 sq. m (140 sq. ft.). The steam pressure is 14 kg per square centimeter (200 lb. per square inch). The boilers are fitted with superheaters designed to give a superheat of about 100 deg. C.

The steam pipes from the four boilers belonging to each turbine convey the steam to a header placed on the reinforcements of the wall between the machine-room and the boiler-room. The headers for the different groups are connected to each other by means of a heavy steam pipe into which an automatic ball-safety valve is inserted. These pipes also contain valves so that each group of boilers, together with the turbine belonging to them, can be run independent of the others. From the headers steam pipes are taken to the turbines. The ashes from the furnaces drop into buckets, which run in the basement on a narrow-gage railway. There are two lines of railway, one for each row of boilers. The ashes are at present transported out to the power-house yard, where they are used for filling purposes.

ECONOMIZERS AND CHIMNEY.

For each group of four boilers there are two Green economizers, each containing 320 tubes of 1 sq. m (10.7 sq. ft.) heating surface. The flues from the four boilers run together before the economizers to one main flue, in which are placed large dampers by means of which the waste gases from the boilers can be led either through the economizers or directly to the chimney. The chimney, which is common for the two groups of boilers belonging to this extension of the plant, is placed a little outside of the economizer house. The height of the chimney is 80 m (264 ft.) and its internal diameter at the top is 4 m (13.2 ft.).

FEED PUMPS.

The feed pumps are located on the second floor of the economizer house. There are two centrifugal pumps for each group of four boilers, the one driven by a steam turbine and the other by a direct-current motor. The latter serves as a reserve for the turbine pump. The condensed steam is taken from the condenser by an electric-motor-driven centrifugal pump placed beside the condenser and is delivered to the water meters, which are located on the upper floor of the economizer house. From here it passes through the feed-water heater, which delivers it into the storage tanks, placed on the floor below the meters. There are two such tanks, each having a volume of 25 cu. m (885 cu. ft.). In the heater the feed water is warmed up by the exhaust steam from the feed-pump turbine. The feed pumps take the water from the storage tanks, mentioned above, and deliver it to the boilers either through the economizers or directly without passing the economizers.

STEAM TURBO-GENERATORS.

The two new turbo-generators, which are shown in Fig. 1, were supplied by the Oerlikon Company, of Switzerland. The turbines are of the reaction type with thirty-four wheels, running at a speed of 750 r.p.m. The generators are designed for a normal output of 6000 kw and a pressure of 6000 volts at 85 per cent power-factor. The speed and load of the generators are controlled from the generator pedestals on the switchgear gallery by means of an electric motor working on the governor of the turbine. The exciting current is obtained from an 80-volt generator directly connected to the turbo-generator. The voltage of the generators is regulated by means of the exciter shunt-field resistor, controlled from the pedestals mentioned above. The generators are inclosed and self-ventilating. They receive the cooling air through an opening in the machine basement leading to the large cooling-air tunnel mentioned above. Each turbine is equipped with a surface condenser located in the cellar below the machine-room. The condenser auxiliaries are all driven by direct-current motors. The steam consumption of the turbines is guaranteed not to exceed 6.15 kg (13.5 lb.) per kw-hour when the output of the generator is 6000 kw at 85 per cent power-factor, the steam pressure at the turbine valve 12.5 kg per square centimeter (175 lb. per square inch), and the temperature of the circulating water 10 deg. C. The generators are designed to stand a short-circuit between the main busbars without taking damage.

HIGH-TENSION SWITCHGEAR.

The electric switching and controlling apparatus are placed on the three upper floors of the five-story gallery along the outer side of the machine-room, as seen in Fig. 8. The two

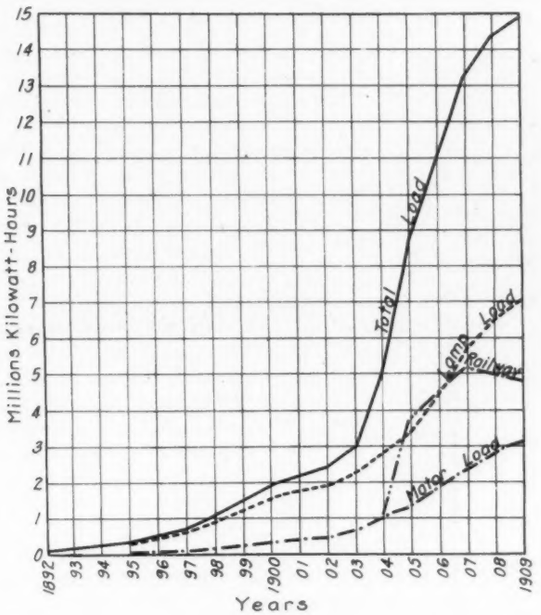


Fig. 3—Diagram Showing Annual Output During the Years 1892-1909.

lower floors of this building, below the engine-room level, are intended to be used as storage-battery rooms for the substation which is located in the power house. However, one part of

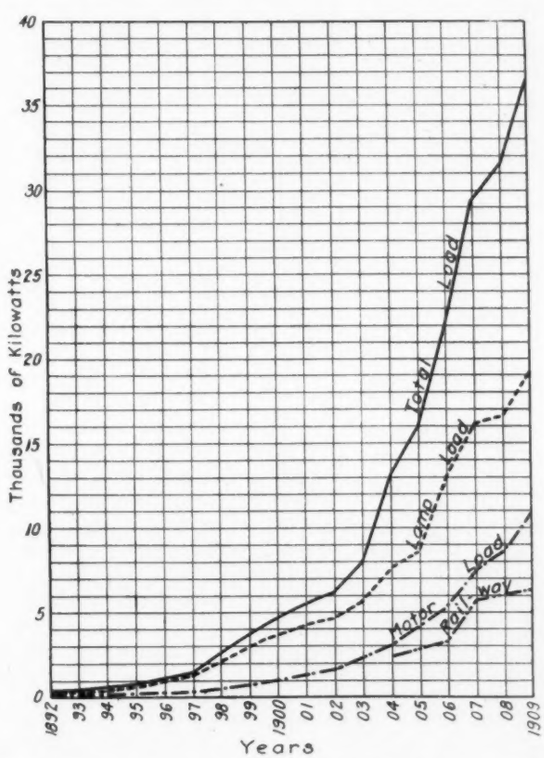


Fig. 4—Diagram Showing Annual Distribution During the Years 1892-1909.

the upper of these two floors is occupied by the switchgear for the five old generators, where these machines are connected by means of oil switches and two sets of busbars in two groups, with the three reciprocating-engine-driven generators in the one and the two turbine-driven in the other group. These two groups are connected up to the main switchgear in the same way as are the 6000-kw generators. The general scheme of the high-tension connections in the Värta station is shown by Fig.

Fig. 5—Traveling Crane and Coal-Carrying Structure.

9. Each generator or group of generators is provided with an automatic oil switch (generator oil switch) fitted with a differential relay which causes the switch to open the circuit as soon as the energy flow is reversed on account of a fault in the generator windings. This relay is a regular overload relay used

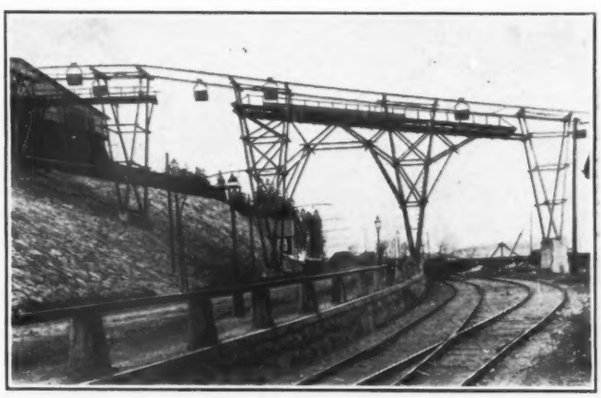


Fig. 6—Coal-Carrying Structure.

in connection with two series transformers, one on each side of the generator winding, in such a way that the tripping solenoid of the relay carries current only when the currents of the

Fig. 7—Coal Yard.

two series-connected transformers are different in strength or displaced in time-phase from each other, as in case of a short-circuit in the generator. There are provided two sets of main

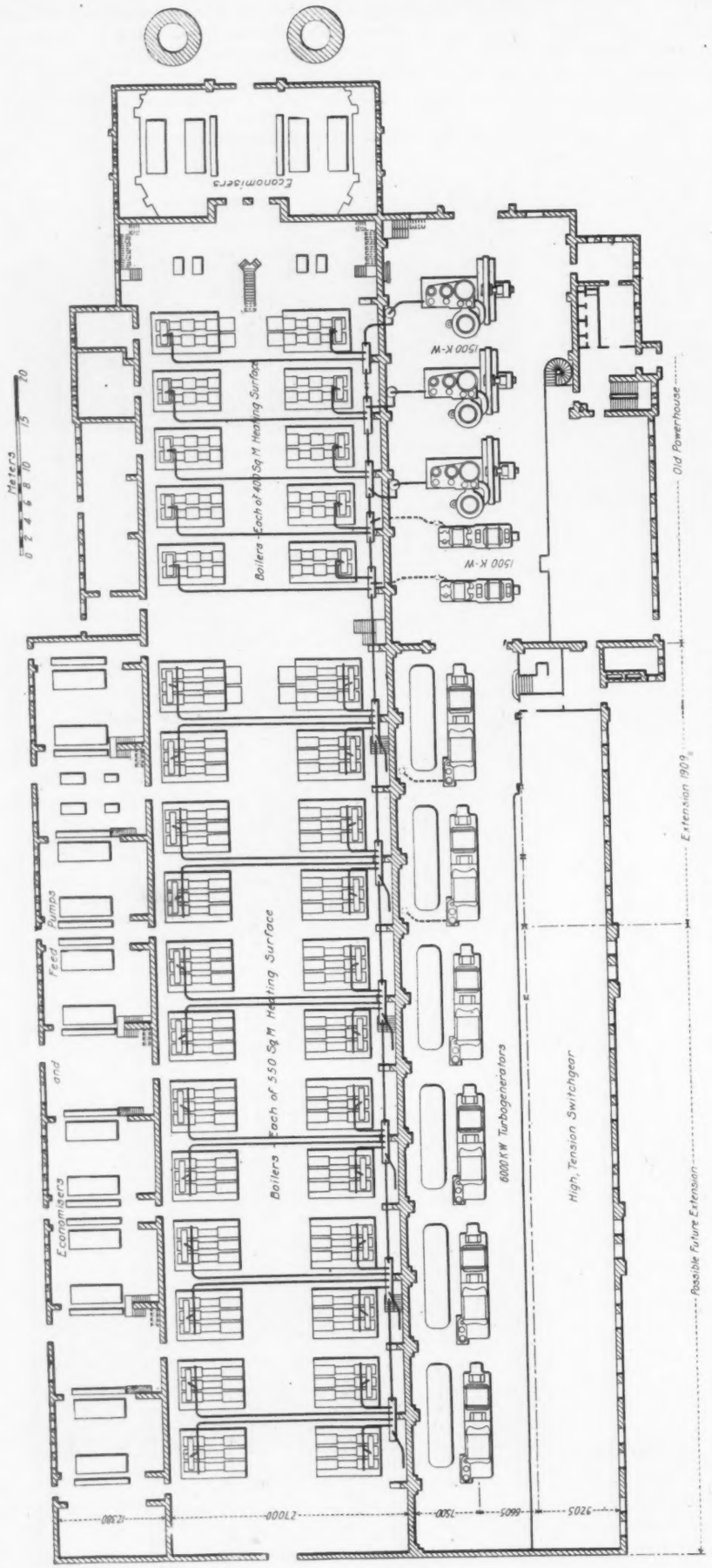


Fig. 8—Plan of the Power House.

busbars which can be divided in sections, one for each generator, by means of heavy, laminated, disconnecting switches. Beyond the generator switch the circuit is divided in two branches, each containing a selector switch by which the generator load can be thrown on either of the two sets of main busbars. These oil switches are not automatic. For each generator (or generator group) there are two cable-group switches, each one feeding energy to a section of the feeder busbars. Space is provided for the connection of four feeders to each one of these sections. The cable-group switches are equipped with overload relays, thereby causing the switch to open as soon as a short-circuit occurs in any one of the feeders connected to it. Should any one of the group switches be damaged, the two sections of the feeder busbars belonging to the same generator are connected together by means of the busbar sectionalizing switches, and thus energy is fed to both sections through the other switch group. Normally the groups are run separated from each other to reduce as much as possible the disturbance caused by any short-circuit in one of the feeders. The feeders contain the feeder oil switches by which they are connected to and disconnected from the feeder buses. These switches are not automatic. They are fitted with charging resistors for allowing the voltage to be raised or lowered gradually when closing or opening the switch, thus preventing the production of dangerous high potentials during the time these operations are being carried on.

On the upper floor are located the main busbars and all the large oil switches—generator switches, selector switches and group switches. Each phase lead of the buses and the switches is inclosed in a fireproof brick cellular compartment. The oil switches are electrically operated and are dimensioned for breaking a load of 30,000 kw, this being the highest amount of energy that will ever have to be handled within one system. In the bottom of the oil-switch cells 4-in. drainage pipes are inserted in order to lead away the burning oil that may be thrown out when the switch opens on a heavy short circuit. Fig. 13 shows the cellular construction of the oil-switch and the busbar compartments.

The feeder buses are located on the second floor. Brick compartments are provided for a second set of feeder buses which are to be used in the future when the Värta station will receive energy from a water-power station on the Dalecarlia River. Compartments containing apparatus

for connecting the feeders to either of these two sets of buses are built along the rear sides of the feeder bus compartments.

The third story contains the feeder oil switches, which are

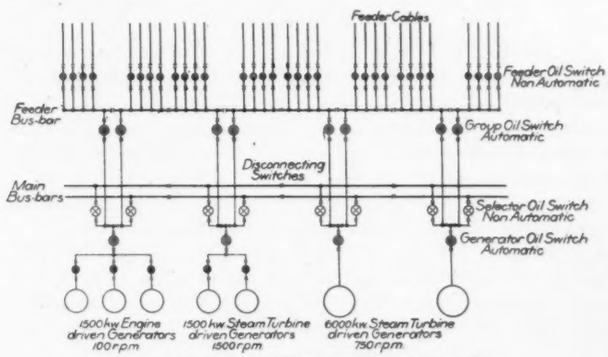

Feeder Cables
Feeder Oil Switch Non Automatic
Feeder Bus-bar
Group Oil Switch Automatic
Disconnecting Switches
Main Bus-bars
Selector Oil Switch Non Automatic
Generator Oil Switch Automatic
1500 kw Engine driven Generators 100 r.p.m.
1500 kw Steam Turbine driven Generators 1500 r.p.m.
6000 kw Steam Turbine driven Generators 750 r.p.m.

Fig. 9—Diagram of High-Tension Connections.

operated by hand from pedestals placed on the floor above. These switches are designed for a normal load of 300 amp and a breaking load of 10,000 kw. This story also accommodates

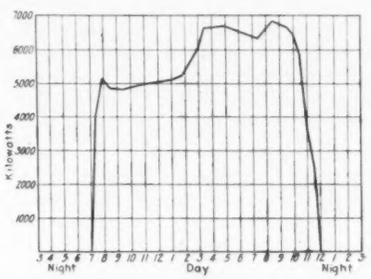


Fig. 10—Day Load.

the series transformers for the feeder ammeters, spark-gaps for the cable protection, series and shunt instrument transformers for the generator and generator group instruments, etc.

The operating apparatus and the instruments are mounted on control pedestals (Fig. 14) which are placed in two rows on a projecting balcony on the second floor so that the operator has a full view of the machine-room. The row nearest to the machine-room contains the generator pedestals, which carry the generator instruments, synchronizing plug contacts, push buttons for controlling the turbine-governor motor mentioned before, controlling switches and signal lamps for the generator and selector switches and a handwheel for operating the exciter-field rheostat, which is placed in the story below. Opposite each generator pedestal is placed in the other row one group pedestal carrying ammeters for the two feeder group circuits belonging to this generator and controlling switches and signal lamps for the two group switches.

The neutral wires of the generators are not grounded, but the neutral point of the system is nevertheless kept at earth potential by means of resistors of high resistance which con-

Fig. 11—Boiler-Room.

nect the main busbars to ground and lead off static charges that may appear on the system.

The iron framework of the switchgear cellular construction, the shells of the generators, oil switches, shunt and series instrument transformers and the instrument and controlling circuits are grounded by means of a heavy ground-wire system.

SUBSTATIONS.

The three-phase energy generated at the Värta station is transmitted by means of underground cables to the substations in the town. The number of these substations is at present five. Their location may be seen from the map in Fig. 2. In the substations the 6000-volt, three-phase energy is transformed to

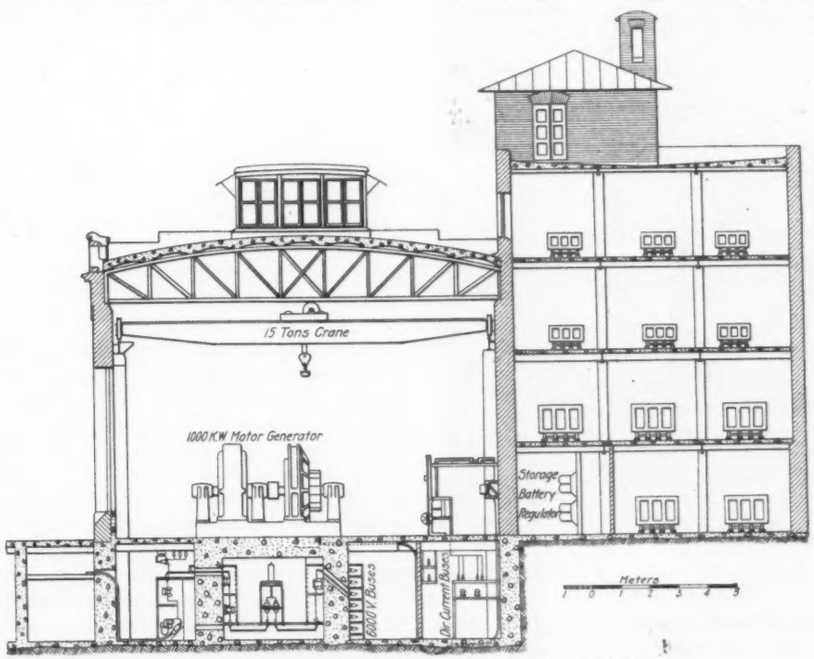


Fig. 12—Cross-Section Through the Tule Substation.

direct current by means of induction motor-generators. Each substation supplies energy to a three-wire, direct-current network at a pressure of 2 × 220 volts. The largest substation, the Tule station, supplies also direct-current energy at 600 volts for street-railway purposes. This station contains eight 1000-kw motor-generators. Fig. 12 shows a section through the Tule station. The substations are equipped with large storage bat-

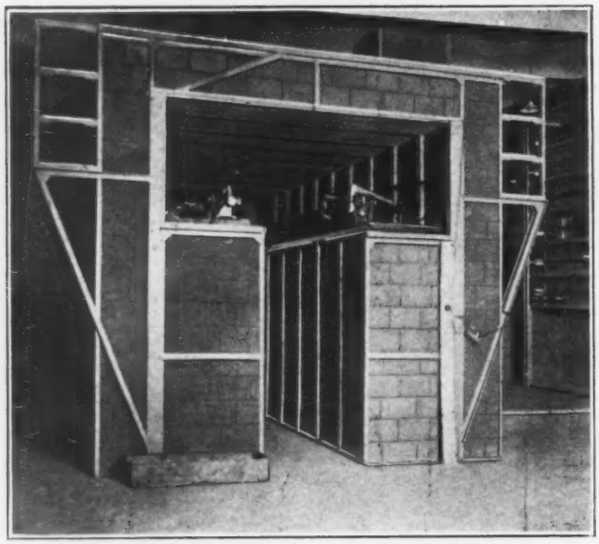


Fig. 13—Oil-Switch Compartment.

teries which carry the peak load and night load. On account of these batteries the Värta station does not run during the night, and its day load is a very favorable one, as may be seen from the curve of Fig. 10, showing the form of the day-load curve during the day of maximum output in the year 1909. The old Brunkeberg station is at present a combination of generator station and substation, containing, in addition to the old steam-engine-driven generators mentioned before, two 500-kw motor-genera-

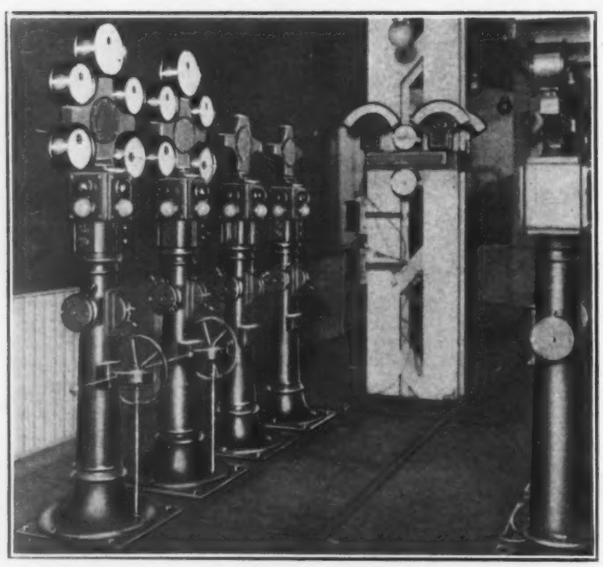


Fig. 14—Switches and Instruments Mounted on Pedestals.

tors, supplied with energy from the Värta station. In the near future the engine-driven generators will be displaced by motor generators, each of 1500 kw rating, thus changing this station to a substation. At the same time the voltage of the direct-current distribution network of this station will be raised from 2 × 110 volts to 2 × 220 volts. By this doubling of the voltage the load rating of the network will be almost quadrupled for the same percentage of loss.

GRAPHICAL SOLUTION OF PROBLEMS INVOLVING PLANE-SURFACE LIGHTING SOURCES.

By A. S. McAllister.

A PROBLEM in lighting the solution of which has usually involved the use of calculus is that relating to the illumination of the floor and walls of a room by a flat-surface souce in the ceiling. There is presented below a graphical solution of this problem for the case of a flat circular source which possesses the maximum of simplicity.

Although the solution of the problem in any practical case involves the use of only straight lines, circles and the lower branches of mathematics, it is not claimed that the proof of the accuracy of the method outlined can be given in such simple terms. However, even the proof is not complicated. It seems well to give first the simplest possible solution and subsequently to outline the proof of the accuracy.

EQUILUX SPHERES.

In Fig. 1 let $A\,C\,B$ represent an edgewise view of a flat circular surface lighting source, assumed to be in the ceiling of a room, having any given value of uniform surface illuminating density and any desired radius. If through the edges A and B there be passed an imaginary sphere of any chosen size—such as $A\,D\,B$—with its center at some point on a vertical line passing through the center C, the inner surface of this imaginary sphere below the lighting source will receive an illumination which will be uniform in intensity normal to the surface throughout the whole interior of the imaginary sphere. Evidently the density of the normal illumination against the inner surface of the sphere will bear to the illumination of the

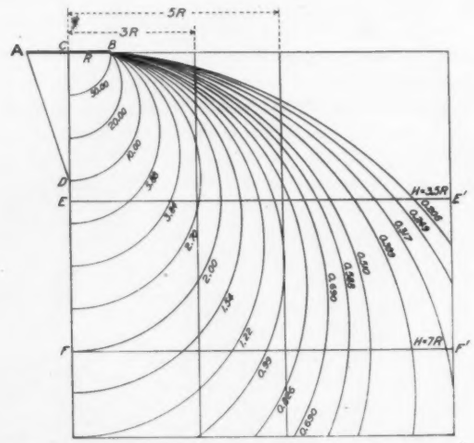


Fig. 1—Equilux Spheres, with Illuminating Values in Per Cent, for Spheres Passing Through Points 1, 2, 3, 4, etc., Length Units Below Source.

circular surface source the inverse ratio of the interior area of the exposed zone of the sphere to the area of the lighting source, since the lumens produced must equal those utilized. This ratio equals the square of the ratio of the radius $A\,C$ to the diagonal $A\,D$; when the radius of the circular source is taken as the unit of length for the measurement of all distances, and the unit of illumination is taken as the surface brilliancy of the source, then the percentage value of the illumination on the interior of the sphere is equal to 100. divided by the square of the diagonal $A\,D$.

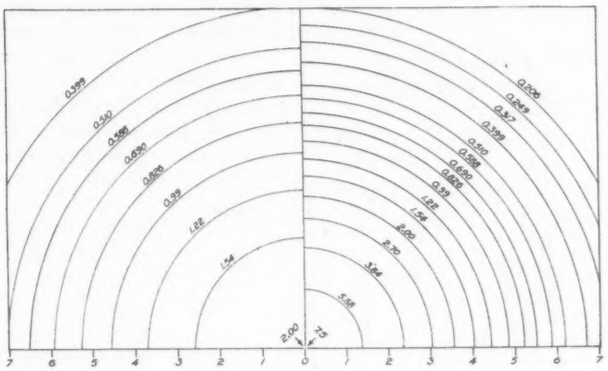
For convenience any sphere passing through the edges A and B, as just indicated, can be referred to as an "equilux" sphere. Equilux spheres of the proper sizes being employed, one is enabled "to explore the whole region" illuminated by the source and to ascertain immediately for any desired point within the space explored the exact value of that component of the light flux which is normal to the particular equilux sphere passing through that point.

In Fig. 1 are indicated numerous equilux spheres and the

points of intersection of these spheres with horizontal planes (floors) at distances of 3.5 units and 7 units of length (radii) below the light source, and with vertical planes 3 and 5 length-units distant from the center of the source.

ILLUMINATION ON HORIZONTAL PLANES.

Intersections of the two assumed horizontal planes (floors) with the equilux spheres are shown in Figs. 2 and 3; evidently the points of equal illumination lie on circles having as the common center the point on the floor immediately below the center of the circular ceiling lighting source. It is an interesting fact that at any point on the floor the component of the



Figs. 2 and 3—Equilux Illumination on Floors 7 Length-Units and 3.5 Length-Units Below Source.

flux normal to the floor is equal to the component normal to the equilux sphere at that point, so that the values of equilux density are simultaneously the values of light flux density normal to the horizontal plane (floor). Expressed in other words, the illumination along the floor at any point is known at once when one has determined the value of light flux density on the equilux sphere passing through that point; the whole problem of floor illumination density and distribution is completely solved when the equilux spheres in Fig. 1 and intersections in Figs. 2 and 3 have been constructed. One could not well wish for a simpler solution. It is especially worthy of note that the square of any diagonal such as $A\,D$—which is used in calculating the value of the illumination

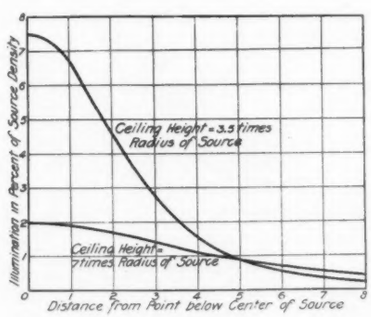

Ceiling Height = 3.5 times Radius of Source
Ceiling Height = 7 times Radius of Source
Illumination in Percent of Source Density
Distance from Point below Center of Source

Fig. 4—Graph of Illumination on Floors with Two Ceiling Heights.

density on each equilux sphere—is in each case equal to the constant quantity 1 plus the square of the height $C\,D$, so that by using whole numbers for assumed height values all of the numerical calculations are reduced to the simple processes of mental arithmetic; as noted above, the graphical constructions involve the use of merely straight lines and circles.

EXAMPLES OF FLOOR ILLUMINATION.

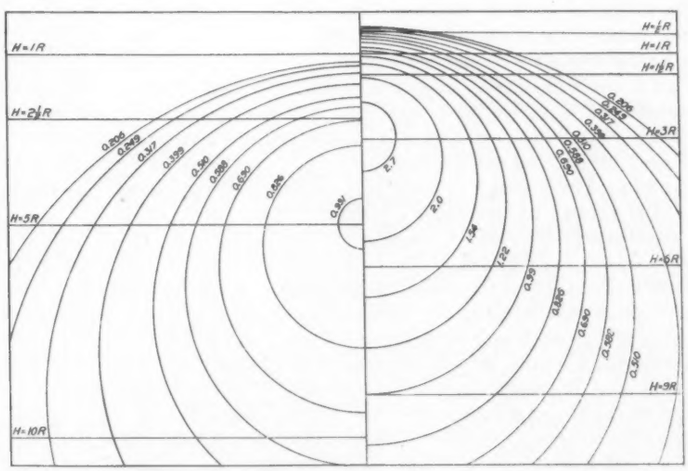
In Fig. 4 are shown results obtained directly from Figs. 2 and 3. It will be noted that with a ceiling height equal to 3.5 times the radius of the lighting source the light flux density at a point on the floor immediately below the center of the source reaches a value of about 7.55 per cent of that of the source, while the density along the floor decreases rapidly with increase in the distance from the point of maximum density. With a ceiling twice as high as formerly the maximum light flux density is reduced to 2 per cent, but the rate of decrease with increase of distance from the point below the center of the source is much less; in fact, at distances greater than 5 units of length (radii) the light from the high source is greater than that from the low source. This fact will be appreciated when it is recalled that the "solid angle" subtended by the source when viewed from the floor at a great distance from the center is larger with the high ceiling than with the low ceiling.

ILLUMINATION ON VERTICAL PLANES.

In Figs. 5 and 6 are shown intersections of the equilux spheres with vertical planes (side walls) at distances of 3 units and 5 units (radii) from the center of the lighting source. The points of equal illumination—normal to the equilux spheres—lie on circles which are not concentric, but which have their centers on a straight vertical line. The method of locating these circles will be appreciated immediately from a brief study of Fig. 1.

Figs. 5 and 6 show directly the value of the equilux illumination at each point indicated, but they do not give the value of the flux density normal to the vertical plane at that point. However, this value can readily be calculated from each illustration by means of mental arithmetic. The process of calculation involves merely the multiplication of the equilux value at the point considered by the (constant) normal horizontal distance of the vertical plane from the center of the source and the division of this constant quantity by the vertical distance of the point below the ceiling.

At all points along a side wall at a distance below the ceiling equal to the normal distance of this wall from the center of the lighting source the vertical component of the flux density is equal to the equilux sphere value, being equal obviously to the horizontal component at these points; at points nearer the ceiling the illumination on the vertical plane is correspondingly greater than the equilux value at each point, while at lower points it is correspondingly less. For example, with a dis-



Figs. 5 and 6—Equilux (Sphere) Illumination at Walls 5 Length-Units and 3 Length-Units from Center of Source.

tance of 3 radii between the wall and the source (Fig. 6) the normal illumination on the wall is equal to the equilux values at a distance of 3 radii below the ceiling; at 1 radius it is three times as great as the equilux value at each point; at 1.5 radii it is twice as great as the equilux value at each point; at 6 radii it is one-half as great; at 9 radii it is one-third as great, etc. From these relations one can easily determine the flux density values over the whole wall area by means of equilux circles such as are shown on Figs. 5 and 6.

OUTLINE OF PROOF OF ACCURACY OF GRAPHICAL CONSTRUCTIONS.

Uniformity of Normal Flux Density on Spheres.—The method outlined above is based primarily on the "solid angle" theory of illumination. In other words, it is assumed that

when a surface source is viewed from two points so located that the "solid angle" subtended by the source in one case is equal to that in the other the light flux densities at the two points are equal; when the two angles are unequal the flux densities differ in the exact ratio of the angles. Referring now to Fig. 7, let $A\,B$ represent a surface source having a plane circular edge through which passes the imaginary sphere $P\,P'\,P''$. Evidently the "solid angle" subtended by the source when viewed from any point within this sphere would be the same whether the source be a plane or the internal zonal section of an imaginary sphere. The source would be seen as a circular plane when viewed from any point not on this line it may be assumed that the source would appear as an ellipse—the error involved in this assumption is of no importance so far as practical results are concerned. It is with the two axes of this ellipse that the present problem deals. In Fig. 7 one of the axes of the ellipse is the straight line $A\,B$, the other axis being perpendicular to this line. At a point, such as P', below the center of the light source the separate plane angles subtended by these two axes are individually equal to the angle α; the "solid angle" is proportional directly to the product of these two separate plane angles, so that the relative value of the solid angle is known when the values of the two plane angles are known. At any point, such as P, on a circle passing through the points A, B and P' the plane angle $A\,P\,B$ subtended by the axis $A\,B$ is equal to the plane angle $A\,P'\,B = \alpha$, and hence is constant without respect to the position of P along the circle $A\,P\,P'\,P''\,B$. The plane angle subtended by the axis of the ellipse at right angles to the axis $A\,B$ is greater for the point P than for the point P' because the distance from which its constant length ($=A\,B$) is viewed is less at P than at P'. The ratio of the two distances indicated, $P\,O \div O\,P'$, is the cosine of the angle $P\,O\,P'$. Since the solid angle subtended by the lighting source when viewed at point P is proportional to the product of the two plane angles subtended by the axes of the source it follows that the solid angle at P is greater than the solid angle at P' in the ratio of unity to the cosine of angle $P\,O\,P'$. Now the flux density normal to the sphere at P bears to the maximum flux density along the line $P\,O$ the ratio of the cosine of angle $P\,O\,P'$ to unity. Hence the normal flux density at P is equal to that at P'; or the normal flux density is uniform over the whole inner surface of the sphere below the lighting source. The slight errors involved in the simplifying assumption used above are not cumulative; in fact, they cancel in the final results. The only error that can rightly be so designated follows from assigning a definite "direction" to the flux which is emitted by an extended surface source. Even this error is zero in so far as the "cosine" law is applicable. It would seem, therefore, that the equality of normal flux density along the inner surface of the imaginary equilux spheres can be treated as sufficiently well established without resort to the complications that a more complete demonstration would involve.

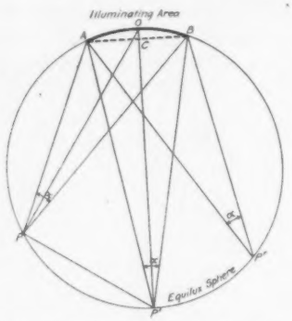


Fig. 7—Proof of Uniformity of Illumination on Sphere Surface.

Value of the Equilux Illumination.—In determining the numerical value of the light flux density along each equilux sphere resort is had to the law of conservation. That is to say, it is assumed merely that all of the flux emitted by the source is utilized in illuminating the interior of the imaginary sphere below the source. Since the flux density is constant over the lighting source and that over the equilux sphere is also constant, it follows at once that the two densities bear to each other the inverse ratio of the two areas. It remains merely to determine the ratio of areas. Referring to Fig. 7 the superficial area of the zone of the sphere below the plane $A\,C\,B$ bears to the whole area of the sphere the ratio of $C\,P'$ to $O\,P'$. The whole area is $\pi\,(O\,P')^2$, and hence the lower zonal area is $\pi\,O\,P' \times C\,P'$. Now from similar triangles $O\,P' \div A\,P' = A\,P' \div C\,P'$, so that $O\,P' \times C\,P' = (A\,P')^2$, therefore the lower zonal area is equal to $\pi\,(A\,P')^2$. The area of the plane circular source is $\pi\,(A\,C)^2$, so that the ratio of the two areas is $(A\,C)^2 \div (A\,P')^2$. When the length $A\,C$ is used as the unit of length the ratio of areas becomes $1 \div (A\,P')^2$, as has been used above. It will be noted that this ratio is absolutely accurate. When use is made of this ratio in connection with the law of conservation relative to the production and utilization of flux, the apparent inaccuracies in the simplified proofs of the uniformity of illumination disappear.

Illumination on Horizontal Planes.—In the solution of the practical problems given above it was assumed that at any point below the lighting source the component of the flux (and hence flux density) normal to a horizontal plane is equal to the equilux sphere value at that point. Since such an assumption involves the conception of definite direction to flux coming from an extended surface source it is open to the objection noted above under "uniformity." However, in so far as any direction can be assigned to the flux from such a source the method here outlined is as accurate as any that can be employed. In Fig. 8 the line showing the mean direction of the flux reaching the point P is shown by the line $O\,P$; this line bisects the angle $Q\,P\,N$ and hence the component of the flux normal to $Q\,P$ is equal to the component normal to $N\,P$. The former component produces the equilux illumination at the point P, while the latter produces the floor illumination at the same point; hence the floor illumination at any point such as P, P' or P'' is equal to the equilux illumination at this same point. The inaccuracies involved in the simplified construction used in Fig. 8 are of no practical importance.

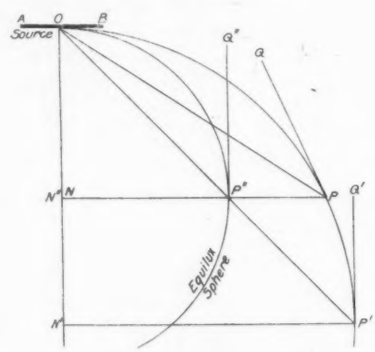


Fig. 8—Proof of Equality of Equilux Sphere and Floor Illuminations.

Illumination on Vertical Planes.—Having determined the horizontal or vertical component of a light flux at any one point and knowing the horizontal and vertical distances from the source to that point one can easily calculate the vertical or horizontal component by the ratio of these two distances. The component on the vertical plane thus found would be the value which would exist normal to a vertical plane passing through the point and perpendicular to a line joining the point and the source. On any other vertical plane passing through the same point the normal component at that point would be less in the ratio to unity of the cosine of the angle of deviation between the two planes. Since the constant horizontal distance from the source to any plane is in each case equal to the product of the cosine just noted and the horizontal dis-

tance to any chosen point on any plane it follows that at any point whatsoever the flux density normal to any vertical plane bears to the equilux illumination at that point the inverse ratio of the vertical distance of that point from the ceiling to the horizontal perpendicular (shortest) distance between the vertical plane and the center of the ceiling lighting source.

SURGES IN PIPE LINES.

By F. G. Baum.

IN 1902 the writer read a paper before the Pacific Coast Transmission Association entitled "Surges in Transmission Circuits." The paper resulted from studying conditions found during switching, etc., on the Bay Counties Power Company's system, which was put into service some time before. The mathematical expression of what took place was so simple as to be almost startling—when one considered all the "higher mathematics" which had been wasted on the subject. Almost the same line of reasoning applies to pipe lines, and hence it may be well to review briefly the electrical surge phenomena when opening a line suddenly before discussing the surges in pipe lines.

Let L = self-induction of line; I = current carried; C = capacity of line; V = voltage rise due to interrupting current I.

The magnetic energy stored in the line of self-induction L carrying current I is $LI^2 \div 2$. When this current is suddenly interrupted the energy must change from the magnetic form to the static by charging the line as a condenser to a higher potential V. The energy stored in the line having a capacity C at the added potential V is $CV^2 \div 2$. These two must be equal, so that

$$LI^2 = CV^2$$

or

$$V = \sqrt{L \div C} \quad I = KI$$

since $\sqrt{L \div C}$ is a constant for any line.

It was shown that this constant is about 200, and we have the very simple relation

$$V = 200\,I$$

or, the e.m.f. rise in volts is about 200 times the interrupted current in amperes. The periodicity of the surge voltage will be

$$f = 1 \div (2\pi \sqrt{LC})$$

The surge voltage is seen to be independent of the length of line, the reason being that each foot of line has magnetic energy stored, and each foot of line also has static capacity to receive the energy.

There are similar phenomena when the valve on a pipe line is suddenly closed. Referring to Fig. 1, let L_p = length of pressure pipe in feet; D = diameter of pressure pipe in inches; t = thickness of pipe at bottom in inches; V_p = velocity in pressure pipe in feet per second.

The energy stored in the column of water of length L_p is equal to $MV_p^2 \div 2$, in which $M = \dfrac{\pi D^2 \times 62.5\, L_p}{4 \times 144 \times g}$; $g = 32$.

This energy must be taken up by doing work on the pipe in enlarging it under the excess pressure, neglecting the elasticity of the water. Assume that the pipe has a uniform grade; hence, the thickness will be $t \div 2$ at the midsection and corresponding at other sections (Fig. 2). Let S = the increased strain per square inch in the metal due to the sudden stopping of the flow. It can be very easily seen that, since the energy stopped at the bottom is double the energy of water stopped before the middle section of the pipe, the expansion of the pipe will be the same at the bottom as at the midsection, or, in other words, the elongation of each ring of pipe will be the same from top to bottom, assuming the thickness to vary in proportion to the distance from the lower end. (This is not strictly true, since pipe grades are not uniform and the upper end must have an appreciable thickness in any event. The assumption, however, is on the safe side.) Since the elongation in all sections will be the same, the added stress per square inch will be the same in all sections. Let S = added strain in pounds per square inch; $\frac{t}{2}$ = mean thickness in inches; e = elongation per inch; M = modulus of elasticity = 28,000,000; 62 = weight of 1 cu. ft. of water in pounds.

Then the work done on the pipe to elongate a ring section 1 ft. long and πD in circumference will be

$$12\,S\,\frac{t}{2}\,\frac{e\pi D}{12} \text{ in ft.-pounds,}$$

and since

$$e = S \div M,$$

the above result is equal to

$$\frac{S^2}{M}\,\pi D\,\frac{t}{2} \times L_p \text{ for a length of pipe } L_p.$$

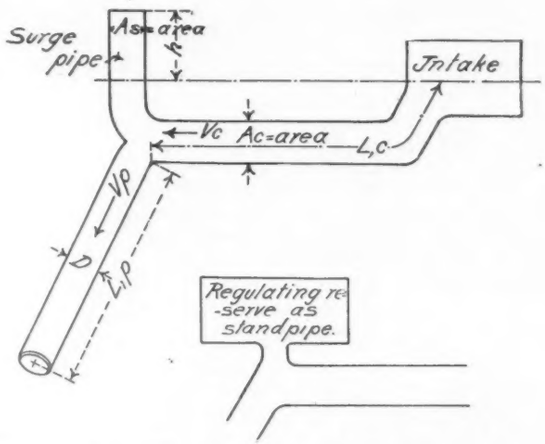


Fig. 1—Explanation of Symbols Used.

The equations of energy must equal, therefore,

$$\frac{S^2}{M}\,\pi\,D\,\frac{t}{2}\,L_p = \frac{MV_p^2}{2} = \frac{62.\,D^2 L_p V_p^2}{24 \times 144 \times g}$$

or

$$S = 307\,V_p \sqrt{D \div t} \qquad (1)$$

That is, the added stress per square inch, due to the sudden interruption of the water flowing under velocity V_p, is as given by equation (1).

For a given pipe, then, $S = KV$ is the same form as the expression for the increase in electrical pressure when current I is interrupted in a transmission line.

Fig. 3 shows the above equation plotted with S vertical and $D \div t$ horizontal. For various values of V there are series of parabolas as shown.

Example: In a 60-in. pipe, 0.5 in. thick at bottom, what is the excess fiber strain in the pipe due to the sudden stopping of the water flowing at a velocity of 5 ft. per second? $D \div t = 120$, hence, following the vertical to curve for $V = 5$, there is found $S = 17{,}000$ lb. per square inch. If $V = 15$, $S = 50{,}000$ lb. per square inch.

The total strain in pipe will be the above added to the initial strain due to the static pressure.

By combining formula (1) with the ordinary formula connecting pressure, diameter, thickness and strain per square inch in pipe, that is,

$$pD = 2\,St \qquad (2)$$

in which p = pressure per square inch due to water; D = diameter of pipe; S = stress per square inch; t = thickness, there is obtained (after substituting 2.3 h for p) the equation for the excess pressure expressed in feet of head due to suddenly stopping the flow V. That is

$$h = 1415\,V \sqrt{t \div D} \qquad (3)$$

This equation is plotted in Fig. 4 for various values of V.

The application is the same as above illustrated, except that the feet-head value is obtained instead of the pressure per square inch.

The added pressure is independent of the length of pipe because each foot of pipe which adds to the energy of water also adds to the length of pipe on which work is done. The above curves are for instant closure and, of course, give the extreme case. It is seen that sudden closure is dangerous and it is necessary to give time to the closing of the gates.

In case the water flowing at a velocity V is stopped in T seconds, another method of determining the rise in pressure may be used. (It is not entirely accurate, as, in this case, the energy given up to the pipe is neglected.)

A body of water having mass M is moving at a velocity V; it is desired to bring the mass M to rest; that is, to decelerate the mass M at a rate $V \div T = a$. The force necessary to do this is Ma. If p represents the added pressure per square inch at

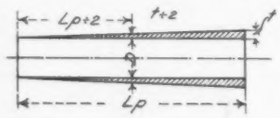


Fig. 2—Pipe Dimensions.

the lower end of the pipe, the opposing total pressure (to Ma) is p 144 A_p, A_p being the area of the pipe.

Therefore,

$$p\ 144\ A_p = Ma = 62 \times L_p A_p \times a \div g$$

or,

$$p = 0.0135\ L_p a \qquad (4)$$

In this case the rise in pressure is seen to be proportional to the length of the pipe and to the rate at which the water is brought to rest. Figs. 5 and 6 show the relations between p and L for rates of retardation varying from 1.0 ft. to 15.0 ft. per second per second.

Example: $L_p = 3500$, and the water is uniformly brought to rest from a velocity of 10 ft. per second to zero in two seconds. The retardation is 5 ft. per second per second, and the rise in pressure is seen from the curve to be about 230 lb. per square inch.

The actual rise will be less than the values given in Figs. 5 and 6, and hence they are on the safe side.

It will be necessary generally to allow a certain time for closing, and in turbine units safety generally requires by-pass gates, since standpipes will not afford entire relief and cannot

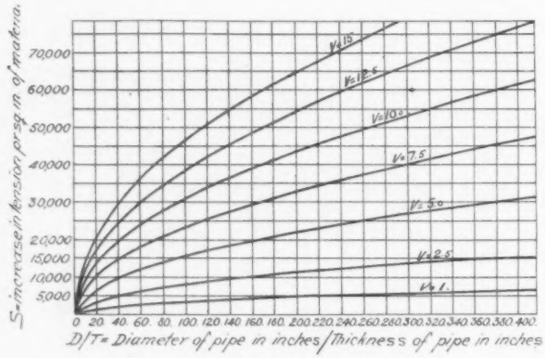


Fig. 3—Graphs of Equation (1).

generally affect the pressure pipe to make them safe. With the use of governor-operated by-pass gates (which will close slowly) entire safety can be had, as can also good speed regulation.

The above method takes account of only the water in the pressure pipe. There may be also a long conduit L_c from the intake to the pressure pipe. Unless there is some form of relief all the water in the conduit will add its energy to that in the pressure pipe. To reduce the strain on the pressure pipe as much as possible there is generally installed a small regulating reservoir at the end of the conduit. This reservoir can take care of the sudden demands for more water, or can receive water not demanded by the power station for a short time.

In Fig. 1 let L_c = length of conduit, V_c = the velocity in the conduit and A_s = the surge pipe area. The valve x is closed suddenly on the pressure pipe. The water in the conduit must now find relief by rising in the surge pipe. The energy of the water $MV_c^2 \div 2$ flowing in the conduit must now be given up by raising the level of the water in the surge pipe

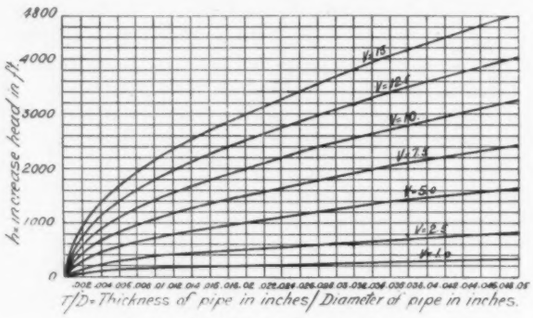


Fig. 4—Graphs of Equation (3).

until the work done on the water raised is equal to the energy of the water under velocity V_c. Let h = the height of the water in the surge pipe when all of the energy is given up; that is, when V_c is equal to zero. The balancing conditions are reached when

$$MV_c^2 \div 2 = Wh \div 2$$

in which W is the weight of water raised through a height $h \div 2$; giving

$$\frac{62.0 \times A_c L_c V_c^2}{2g} = 62.\ A_s h\ \frac{h}{2}, \text{ or}$$

$$h = V\sqrt{\frac{L_c}{g}\frac{A_c}{A_s}} \qquad (5a)$$

If $A_c = A_s$, then

$$h = V\sqrt{L_c \div g} \qquad (5b)$$

Equation 5b is plotted in Fig. 7 for $A_c = A_s$, the vertical scale being at the left. For $A_s = 100\ A_c$, h is divided by 10 and use is made of the right-hand vertical scale. When $A_c = 4\ A_s$, the left-hand scale of h would be multiplied by 2.

Suppose the conduit length = 10,000 ft. and $v = 10$, $A_s = A_c$, then $h = 175$ ft. When the surge pipe area is equal to one-

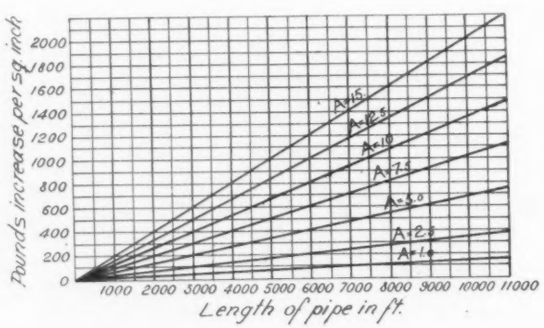


Fig. 5—Graphs of Equation (4).

fourth of the conduit area, $h = 350$ ft. When $A_s = 100\ A_c$, $L = 10{,}000$ ft. and $V = 10$, then $h = 17.5$ ft.

If A_s were equal to one-fourth of A_c the height to which the water would be raised would be 350 ft. for a conduit 10,000 ft. long and the water moving at a velocity of 10 ft. per second. (If the length of the conduit were doubled, the head would be increased by $\sqrt{2}$ according to formula 5.) When the velocity is retarded from 10 ft. per second to, say, 7.5 ft. per second, the surge head will be the difference in the vertical projection from the corresponding V curves; in this case the difference

between 2×175 and 2×132.5, or $350 - 265 = 85$ ft. ($A_c = 4\,A_s$).

If $A_c = A_s$, then for the same change in velocity h would have the value $175 - 132.5 = 42.5$ ft.

It is seen, therefore, that when the surge pipe is about equal to or less than the conduit area there is a large difference in elevation of the water in the surge pipe. This result is hard to take care of with the conditions usually found in installations A very scientific and theoretical paper was presented by Mr. R. D. Johnson before the American Society of Mechanical Engineers in 1908. In this paper a method of reducing the surge and the pulsation was offered by the use of a differential surge pipe.

It is believed, however, that where possible a small regulating reservoir should be located at the end of the conduit. It was seen above that when the stand pipe area is 100 times the conduit area the surge height is reduced to one-tenth. Such a regulating reservoir would be quite small and could generally be used. It is believed that such a solution of the problem will prove much more satisfactory than the use of any type of surge pipe.

As a matter of fact the surge pipe (where it is nearly of the same area as the conduit) may be a source of danger and add to the difficulties of regulation. In Equation 5*b* if $A_c = A_s$, then $h = V \sqrt{L_c \div g}$, and the height of the surge is shown by Fig. 7. Now, when the water reaches the height h the velocity in the conduit will be zero—or, if the velocity has been changed from 10 to, say, 7.5, then the velocity will be 7.5. There is now an unsupported column of water of height h and this now will act against the conduit head and produce a change of velocity until V_c is equal to the original, *but opposite in direction.* This condition will tend to discharge the conduit water into the intake and it may result in breaking the water column between the conduit and the pressure pipe, and it will necessarily affect the pressure under which the water-wheels are operating and hence change the governing conditions and may result in demoralizing the entire regulating relations due to the repeated

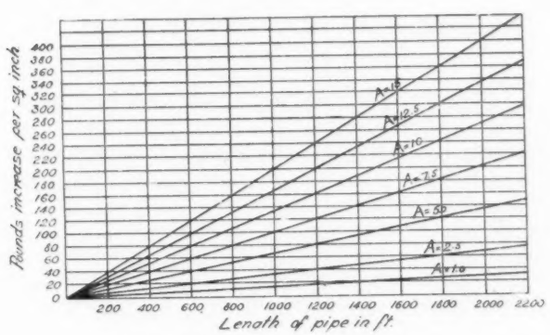


Fig. 6—Graphs of Equation (4).

oscillation of the water and the resulting periodic changes in pressure.

The oscillations in the water will continue until the friction in the conduit takes up the energy $MV_c^2 \div 2$. The time of a complete vibration in seconds (one-half period) will be

$$t = \pi \sqrt{\frac{\text{Length of water column}}{g}} = \pi \sqrt{\frac{L_c}{g}}$$

or the same as a pendulum of length equal to the water column under motion. (The development of this equation is given by Johnson in the paper referred to above.)

Equation 5*a* is

$$h = V \sqrt{\frac{L_c}{g} \frac{A_c}{A_s}}$$

If the surge pipe is shorter than h the water will spout out of the end. If, for example, $A_c = 4\,A_s$ and $L = 10{,}000$ ft., then $h = 350$ ft. Suppose the surge pipe is only 50 ft. high. There is a reduction in area of four to one to the end of the surge pipe, and the water will issue therefrom at a velocity four times the conduit velocity, in this case at 40 ft. per second. That is, there is a nozzle effect which must be taken into account. The instantaneous surge pressure will be larger than corresponds to the height of surge pipe, as there would be added the head $V^2 \div 2g$ (which in this case would be about 27 ft.) to the surge pipe height.

As stated above, a small regulating reservoir at the end of the conduit will, it is believed, prove a much more satisfactory solution than any surge pipe; a surge pipe should be used only where no other solution is possible.

In reviewing the above treatment it is to be noted that equations 1, 3 and 4 show that too sudden closure of gates may result in rupture of pressure pipes and that, where quick action

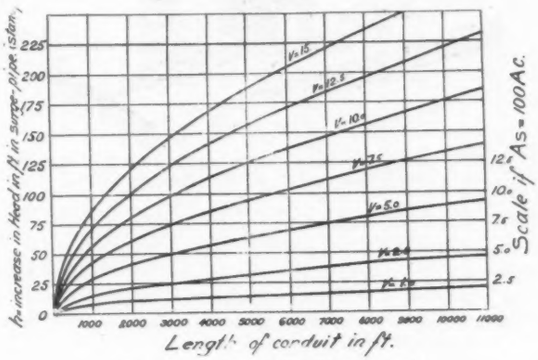


Fig. 7—Graphs of Equation (5b).

in closing gates is necessary for speed regulation, by-pass gates are necessary for the safety of the pressure pipes. Equation 5 shows that the surge height can best be limited by making the surge pipe a regulating reservoir, and it is believed that this solution of the problem is safer and better than the use of any kind of surge pipe. The results and the curves given, while not strictly accurate, are believed to be safe as a guide to avoid dangers and to insure satisfactory operating conditions where properly applied.

Electrolytic Detector for Wireless Telegraph.

Some of the earliest work done in this country in the development of wireless-telegraph receivers of the electrolytic type was carried on by Dr. Lee de Forest and Mr. Edwin H. Smythe in Chicago about ten years ago. At that time Dr. de Forest and Mr. Smythe developed the type of receiver or detector in which electrolytic action operated to build up a delicate metallic filament between the two electrodes of the receiver, the filament being broken by the wireless impulse and being immediately renewed by a local current. In June, 1901, during the development of this metallic-filament detector Mr. Smythe conceived and made a sketch of a type of electrolytic receiver, which, together with some subsequent improvements resulting from a long series of experiments, is illustrated and described in a patent issued to Mr. Smythe on Nov. 8, 1910, entitled "Receiving Apparatus for Electromagnetic Waves." The application for this patent was filed July 24, 1906. The device covered by the patent is of the type in which one of the electrodes of the detector has a minute contact surface which is polarized by the local current to stop the current flow, the wireless impulse acting to depolarize the surface momentarily and permit the passage of the current.

Referring to the accompanying illustrations, Fig. 1 shows the detector mounted on an insulating base and connected by connecting clips with two binding posts, to which the wires of the receiving circuit may be connected. Fig. 2 is a vertical section of the detector proper. This device is in the form of a small spool of graphite, which is itself one of the electrodes and is

hollowed out to form a receptacle for the electrolyte. The lower part has an axial bore to receive the other electrode. A glass stem is introduced in this bore, with its upper end sealed about the lower electrode, which consists of a length of small platinum wire cut off short where it penetrates the stem, so that a very small area is exposed to the electrolyte. A larger wire is fused to the platinum electrode and extends through the stem to the metallic plate at the base of the detector, making contact with one side of the circuit by means of one of the connecting clips shown in Fig. 1. As stated, the spool itself is the other electrode and it is placed in contact with the other connecting clip, as represented in Fig. 1. Sulphur is used for sealing the glass stem into the base of the spool of graphite. The device is to be used in connection with a local-battery circuit, as is the case with other electrolytic detectors.

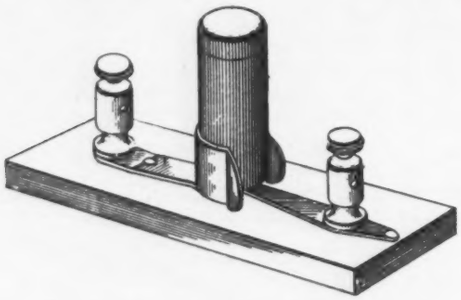


Fig. 1—Arrangement of Detector in Circuit.

Eleven claims are allowed in Mr. Smythe's patent. Of these the first and the fourth show the scope of the invention, and are as follows:

"An electromagnetic wave detector comprising an electrolyte and a cathode and an anode having a very small area and a relatively large area, respectively, exposed to said electrolyte. An electromagnetic wave detector comprising a minute metallic cathode, a relatively large carbon anode and an interposed electrolyte."

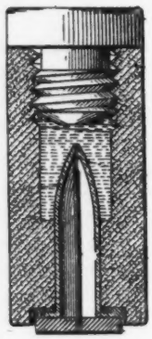


Fig. 2—Vertical Section of Detector.

Central Station

Management, Policies and Commercial Methods

RESIDENCE RATES IN TORONTO.

The City of Toronto Hydroelectric System, as it is popularly known (this being the name under which the municipality retails hydroelectric power purchased wholesale), has adopted a peculiar residence rate. This consists of a flat readiness-to-serve charge of 10 cents per room per month, to which is added 3 cents per kw-hour for all electrical energy consumed. Only the inhabited rooms of the house are counted. This rate is naturally one which appeals principally to owners of small houses. So far it has been in practical use only in one part of the city among the consumers of a small distributing system supplied by steam plants. It is intended, however, to apply this generally over the whole system as soon as the hydroelectric power service is begun.

EIGHT MILES OF CURB-POST TUNGSTEN LIGHTING IN MINNEAPOLIS.

The ornamental tungsten-standard street lighting of Minneapolis now comprises 510 posts in all, extending along both curbs throughout seventy-five blocks, or about eight miles of single-curb lighting in all. The posts, each carrying five 100-watt tungsten lamps mounted upright, are erected at 80-ft. intervals and represent a total connected load of 255 kw. This special street lighting was installed by adjacent property owners, who paid $2 a front foot, which amount was sufficient to set aside a small surplus to be used in paying for posts where the abutting merchants refused to share in the expense. The tenants or owners also paid $1.25 a front foot for the first year's operation of the posts, following which the city will take over and operate the system. The energy for this ornamental lighting is supplied by the Minneapolis General Electric Company, which receives $78 a year for each 500-watt post, including maintenance and renewals.

OLD-RESIDENCE WIRING CAMPAIGN.

The Menominee & Marinette Light & Traction Company has for several months past conducted a vigorous campaign for residence lighting, and to further this object has made an attractive offer for house wiring. Large space is taken in the local newspapers, in which are prominently displayed two offers, one under each of the respective heads: "We will wire your house for a song" and "We will light your house for $1 a month."

The first-mentioned offer is to wire six rooms complete and ready for lighting with individual switches, tungsten lamps and shades, all for $25 per month on easy monthly payments if desired. All wiring will, it is stated, be connected so far as possible and will strictly conform with the requirements of the National Electrical Code. More than seventy-five contracts have thus far been closed under this offer.

The offer to light a house for $1 a month applies to four 20-cp tungsten lamps, which may be turned on as long as necessary during lighting hours. For $1.25 per month the number of lamps may be increased to five, or to six for $1.50 per month. The company is protected in this offer by the installation of a flicker control.

The same company has been very successful in a campaign to displace gasoline commercial lighting with the electric light. Six months ago there were approximately 100 gasoline lighting installations in Marinette, while at the present time there are less than twenty. The company also devotes large newspaper space to this line of its activity, and displays in prominent type the names of the merchants and others who have abandoned gasoline in favor of the electric light.

SPECIAL STREET LIGHTING IN TORONTO.

The City of Toronto is soon to undertake the electric lighting of its own streets with power purchased from the provincial government. Considerable work has been done by Mr. W. Randolph Sweany and other engineers of the municipality, who have been carrying on experiments to perfect a satisfactory and substantial system for lighting the streets of the entire city. In the downtown district the use of ornamental iron posts carrying five 100-watt tungsten lamps in accordance with practice in many other cities has been adopted. For the residence streets, where the electric distributing lines are overhead, a system using concrete poles has been worked out. These poles are 24 ft. high, placed 4 ft. in the ground, and are, of course, provided with steel reinforcing in the center. The distribution-system wires are carried on top of the pole and part way down the pole are lanterns with cylindrical "Alba" globes surrounding a 100-watt lamp for each post. The wires from the top of the post to the lantern are carried inside of the post. The whole presents a very neat appearance. Mr. Sweany says that the cost of these posts has now been brought down to less than $4 each, which is considered a remarkably good figure for a reinforced-concrete post.

RESULTS OF ELECTRIC HEATING APPARATUS CAMPAIGN IN DULUTH.

In August the Duluth Edison Electric Company sent to 7500 of its consumers a blank form asking information about the electric heating or cooking appliances already owned or used by them and inquiring what other apparatus they would care to have demonstrated to them by the company's solicitors. As a reward for filling out this inquiry blank consumers were offered a special discount of 5 per cent on the current month's bill.

Of the 7500 customers addressed 1500 filled out the blanks giving the information desired. Among these, 200 expressed interest in some particular device not in use by them. Solicitors were employed to visit these prospects and succeeded in selling them fifty appliances in all, of which thirty-two were irons. The cost of the inquiry and campaign, including solicitors' time and rebate allowed on bills in return for answering blanks, was $125. The results of the campaign thus inaugurated, however, are not believed to end with the present sale of apparatus, as it is thought that the suggestions given the other 150 prospects will make heating-appliance consumers of some of them next year.

AN INTRODUCTORY POWER RATE.

To encourage the use of electrical energy among factories hitherto operated by isolated steam plants or other power the Chippewa Valley Railway, Light & Power Company, which supplies electric service in Eau Claire, Chippewa Falls and Menomonie, Wis., and Red Wing, Minn., has inaugurated an "introductory power" rate by which it refunds to manufacturers changing over to its electrical service part of the cost of making the motor installation.

The amount of this refund is 25 per cent of the cost of installation and it is paid to the manufacturers (who purchase their electrical equipment from the company and enter an agreement to use its service exclusively for three years) in the form of monthly instalments—virtually credits—each equal to the customer's corresponding monthly bill for energy consumed. If within the three-year period the customer chooses to cancel his contract for service he becomes liable for an aggregate amount equal to the sum of the refund payments or credits granted him.

This "introductory-power" rebate relates to the central-station company's wholesale power schedule, in accordance with which large users of electrical energy pay 1.2 cents per hp-hour at 20 per cent load-factor; 1 cent per hp-hour at 30 per cent to 40 per cent load-factor, and 0.75 cent per hp-hour at load-factors above 60 per cent. The minimum monthly bill under this form of contract is $150 and the minimum charge per kilowatt of demand is $1.50.

Thus the manufacturer who enters into the agreement, even when paying the minimum rate for his connected horse-power in motors, will shortly consume the equivalent of a quarter of the cost of his installation, after which he becomes a profitable consumer to the central station. The Chippewa Valley company now has about 2000 hp in connected-motor load at Eau Claire, part of which was secured through the operation of the introductory rate described.

CENTRAL-STATION HEATING TO CONSERVE THE NATURAL RESOURCES.

By F. H. Stevens.

Central-station heating has long since passed the experimental stage and is now on a substantial basis. Systems are being operated on a successful commercial basis in a great number of cities—many more than the majority of managers are aware—including some of the largest cities of the United States.

Many of the operators of electric generating plants are of the opinion that if they install a central-station heating system it will increase the cost of generating electric current to such an extent that it will not be offset by the revenue derived from the sale of heat. This is true in only a very few places where the electric load on any one engine far exceeds the total heat load.

In these days, when the matter of conserving the natural resources of the country forms one of the leading subjects of discussion by our federal government, it would be well for us to see wherein we may conserve one of the most essential of our natural resources, coal, by utilizing the greatest amount of the available heat units in each pound of coal that we burn and putting it to a commercial use instead of dissipating it through a condenser or throwing it away to the atmosphere in the shape of exhaust steam.

The possibility of economy in steam engines of any class lies almost entirely in the range on the thermometer scale through which the heat can be driven, or, in other words, the "heat head."

This range in the engine of early days was limited because the height of the head was limited on account of strength in construction. In the days of Watt's engine steam was generated at about 212 deg. in a boiler that would not stand pressure and exhausted into a condenser with a partial vacuum with a temperature of about 132 deg., giving a heat head of only about 80 deg. The amount of heat supplied to the engine, about 32 deg., was approximately 1146 pound-Fahrenheit heat units per pound of steam, and the amount thrown away in the condenser was 1122 heat units, leaving only 24 units per pound of steam actually turned into power.

With the modern power-station equipment boilers deliver the steam to the engines at as high as 200 lb. gage pressure with 1200 heat units per pound of steam, or 388 deg. Fahr. In the case of condensing engines they exhaust to a temperature of about 125 deg. Fahr. (26 in. vacuum) or 1120 heat units per pound of steam, giving a heat head of 263 deg., or absorbing 80 units per pound of steam which is utilized for power, but still dissipating or throwing away 1120 units per pound of steam; for the lower temperature on the thermometer scale has not materially changed from the days of Watt to the present time with Corliss engines and steam turbines. It shows that we are still wasting 1026 heat units per pound of steam (being the latent heat of vaporization) that are available for heating purposes at least part of the year.

The majority of non-condensing Corliss engines in use today in electric generating plants take steam at 150 lb. gage

pressure, corresponding to a temperature of 365 deg. Fahr., containing 1193 heat units per pound of steam, and exhaust to the atmosphere at 212 deg. Fahr., a thermometer scale range of 153 deg. Fahr., with the exhaust containing a total of 1146 units (above 32 deg.) per pound of steam. We thus have converted but 47 heat units per pound of steam into power, leaving approximately 1000 units per pound of steam available for heating purposes on a non-condensing basis, this being the latent heat plus the available sensible heat.

With coal having a thermal value of 12,000 heat units per pound and an average efficiency of 7 lb. of water evaporated per pound of coal burned, it will readily be seen that we utilize in our modern station equipment with so-called high-economy prime movers only about 4½ per cent of the total heat delivered to the engine which is actually turned into power.

Here is where we may assist in the conserving of the natural resources by utilizing the heat which is now dissipated through the condenser or thrown away in the exhaust to the atmosphere by conveying it to buildings which require artificial heat several months of the year.

The lowest point on the thermometer scale at which steam can be utilized for heating is governed by the fact that 70 deg. Fahr. is considered the temperature of ordinary personal comfort, and in order to produce this temperature by transferring heat from the surfaces of radiators and pipes a certain heat head must be maintained between the desired temperature of the rooms and the fluid used to convey the heat. We now come to the question of the most desirable method of conveying the heat expelled by the engine to the point where it is to be utilized, as in the heating of buildings, water for domestic or manufacturing purposes, the warming of water in swimming pools, etc. The conditions in the territory where heat is to be sold, and not those in the station, govern what system should be installed, steam or water.

In the case of a system circulating water as a means of conveying heat it is possible to change the condition under which the engine operates from that of exhausting at atmospheric pressure in the extreme cold weather to that of a partial vacuum in mild weather, which means that if the radiators are of the size usual in hot-water heating practice the vacuum on the engine can run as high as 26 in. if the heat load does not exceed the engine load.

In a large majority of cities and towns where the question of installing a central-station heating system is under consideration the number of buildings that are heated by steam far exceeds that of those heated by water. This is particularly true in the business district. Therefore, if a water system is installed, the buildings that are fitted for steam are not prospective customers, as their owners would not change the entire heating system, radiators and piping to accommodate hot-water service. Because of this the installation of a water-heating system in such cases is prohibited. On the other hand, if a steam system is installed the conditions are quite the reverse, for the buildings that are already fitted with hot-water radiation and piping can be heated with remarkable success and economy by heating the water in the building system with steam, continuing to circulate the water through the building system. This is done by substituting for the boiler in the building a water heater in which the steam heats the water. This method is very economical, if properly installed, as it allows of a low range on the thermometer scale at which the heat can be transmitted.

In the buildings that are heated by steam the range of temperature is between 72 deg. and the temperature at which steam can be delivered, or approximately 212 deg., giving a range of 140 deg. Fahr. With these conditions 966 heat units per pound of steam will be transmitted to the room. There can, however, be still a greater saving by the use of cooling coils to extract the heat contained in the water of condensation from the radiators, which still remains over 200 deg. If these coils are properly installed, approximately 100 more heat units per pound of water may be utilized, thus saving the customer about 9 per cent of his steam consumption and utilizing all the heat that is available in the steam, except what is wanted to temper water for domestic purposes.

From the foregoing it will be seen that with a system properly installed it is practical to utilize approximately 90 per cent of the heat supplied to the engine (less transmission losses) instead of 15 per cent, as in the case of a condensing engine with no heating combination.

The difference in the market price of heat sold as power and heat delivered for heating purposes only may give rise to argument as to the advantage of the combination of a power and heating plant, using the exhaust steam for heating and carrying a back pressure on the engine, as against using the steam in a high-efficiency engine with a condenser. It can, however, readily be seen that if the steam required for the heating load equals or exceeds that required for the engine load on a non-condensing basis the revenue from the sale of heat will be considerably more than enough to pay the total cost of fuel for the combination.

Assuming that it takes twice as much steam to produce a horse-power running non-condensing as it takes to produce a horse-power running condensing there will be a gain in the combination whenever the amount of steam required for heating exceeds the amount required for power on a condensing basis; and whenever the amount of steam required for heating equals the amount required for power on a non-condensing basis the gain will be equal to the coal cost for such power.

The foregoing is assuming that the entire plant is being operated either on a condensing or non-condensing basis. In large central power plants the total amount of the output is divided into units, and a portion of the plant may be operated in connection with the heating system, while the rest would be operated condensing.

From the above it is seen that the general rule is that, regardless of the amount of steam required per hp-hour for the engine, the gain in the heating combination will at least equal the total fuel cost of generating the same amount of power in high-efficiency engines if all the exhaust steam is sold for heating at the cost of generating.

There are a great many companies whose heat revenue far exceeds the total fuel account for the twelve months of the year, while some also pay their boiler-room and engine-room labor, water, oil and waste account with the revenue from the sale of heat.

INSTALLING METERS ON PORCHES.

By James S. Wright.

The writer, who was compelled to read his own meters on becoming manager of his plant, was particularly impressed with the time spent in cleaning his feet, in waiting for the front door to be opened, in passing through the house, and, possibly, climbing to the attic, incident to reading meters when installed inside residences. Very frequently the people were not at home, the wait at the door was fruitless, and a second trip was necessary.

Then again there were frequent delays caused by inquisitive housewives, who were never satisfied until their bills were figured for them. The writer reasoned that in the one hundred and twenty times a meter would be read in ten years, at an average of five minutes per reading, and counting on not being able to get in on every twentieth trip, 600 minutes, or ten hours' time, would be required in reading a meter.

Frequently meters already located inside the house are changed to an outside location. Sometimes this is done at the expense of the consumer, who wishes to get away from the annoyance; sometimes the material is paid for and the company donates the labor, and possibly later on the company will change the more troublesome ones at its own expense.

At present about half of the 300 meters are outside. They are usually set on the rear porches, otherwise on the front verandas, but always where rain or snow cannot get at them. The meters are of the glass-covered type and are practically

moisture-proof. Some have been set two years, and so far no objections to their locations have developed.

Two men read the 300 meters, scattered over a territory of about one square mile, in less than one day. The manager firmly believes he is saving one day per month of one man's time and is losing nothing.

Wiring and Illumination

ARC LAMP-POSTS OF NEW YORK.

Details of the Ornamental Standards Used for All Public Lighting on the Streets and Parkways of the City.

IT is doubtful if in any other city of the Western Hemisphere as much care and thought have been bestowed in the design of arc lamp-posts as in the metropolis. As a matter of fact there are very few cities indeed where any effort at all has been made to develop standard posts which will at once fit in with their respective surroundings and measure up to the civic pride of the community and also be representative of its culture. Too often where attempts have been made in isolated cases the result has been all post; a cumbersome shaft wholly incongruous with its surroundings, ill suited as the bearer of a 50-lb. arc lamp and without credit to the city in which it is located.

Beauty of outline and appearance on paper are no criterion of what the finished product will look like when placed on the streets. Few, if any, satisfactory posts have been wholly so designed. Details and ornamentation which stand out on paper are lost when viewed in the post on the street, and regular curves oftentimes appear grotesque. After all, it is the eye which must judge, coupled with one's sense of proportion and the eternal fitness of things. The chief difficulty lies in obtaining a design of graceful proportions which will not be the main object to thrust itself into view and which will withal fit in as well in front of a monumental building as in front of a tenement house. Unfortunately the streets of every city are made up of a heterogeneous mass of brick and stone, typifying the architecture of the Greeks or Romans, or more often architecture so lacking in taste that it cannot be dignified by a name. A Corinthian column might well serve as a lamp-post to grace the portals of a Greek temple, or a gargoyle hold in its mouth the lamp which illuminates the street in front of a gothic edifice; but such buildings are exceptional and, besides, no lighting company can afford individual treatment of blocks, not to mention the unpardonable lack of symmetry which would result.

Fig. 1—Bishop's Crook Post.

Fig. 2—Fifth Avenue Post.

Fig. 3—Lyre-Top Post.

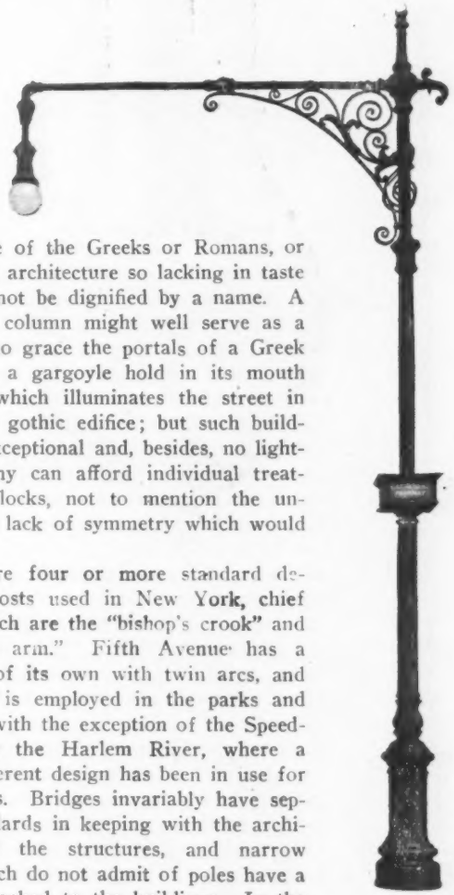


Fig. 4 — Mast-Arm Post.

There are four or more standard designs of posts used in New York, chief among which are the "bishop's crook" and the "mast arm." Fifth Avenue has a treatment of its own with twin arcs, and the "lyre" is employed in the parks and parkways with the exception of the Speedway along the Harlem River, where a totally different design has been in use for many years. Bridges invariably have separate standards in keeping with the architecture of the structures, and narrow streets which do not admit of poles have a bracket attached to the buildings. In the public squares where twin Blondel-type flaming arcs are employed 50-ft. wooden poles with iron ornamentation are used, while a bishop's crook type of post is used where flaming arcs with inclined electrodes are employed.

BISHOP'S CROOK POST.

This post was originally designed or evolved from a number of designs and photographs of posts in use in Continental cities. Before any posts were made a number of plaster and wooden models were prepared and assembled in the modeling shops of the J. L. Mott Iron Works.

The proportions and outlines were changed many times until the post as it now exists was evolved. The base is cylindrical in form, with graceful inward curve, surmounted by an ornamental cusp composed of a series of acanthus leaves to form a supporting member for the fluted column forming the shaft of the post. The shaft also shows considerable study, as the treatment of the decoration is entirely different from the regulation lamp-post. The flutings are of a delicate, refined character and the lower section is entwined with a festoon of oak leaves. The bishop's crook fixture on top is also worthy of notice, as it forms a logical ending for the long, graceful shaft, and the transition from the crook to the arc lamp is so imperceptible that the pole seems to be one complete whole. When standing at a distance of from 50 ft. to 100 ft. from the pole one can better appreciate the grace, beauty and tapering growth of the whole fixture. The Edison nameplate is cast in

one side of the base, while opposite it, in the door, is the coat-of-arms of the City of New York.

The post is made in three pieces: a base and a shaft of cast iron and a crook of steel with cast-iron ornamentation. The base is reinforced within and a rod is inclosed in the shaft above the base line so that should the shaft or crook break it will not fall to the street. The weight of the base is 900 lb., the weight of the shaft is 350 lb. and the weight of the crook is 125 lb., so that the post complete with a 50-lb. lamp weighs 1425 lb.

Fig. 5—Detail of Lyre Top.

Fig. 6—Detail of Bishop's Crook Top.

The base is set 3 ft. 4 in. below grade in an excavation 4 ft. by 3 ft. square, and after the conduit bearing the lead-incased cables is inserted the excavation and base are filled with a 1:2:3 concrete. The shaft has a male joint at both ends, one end being dropped in an accurately fitting socket in the base for a distance of 14 in., the crook fitting the other end and being held in its proper relation to the street intersection or street by three set-screws. The height of the post above grade is 22 ft. 4 in. and the lamp is suspended 18 ft. above the sidewalk. Standard direct-current, inclosed arc lamps are employed, and fed with electric energy from the 120-240-volt underground three-wire system. A 3-in. iron conduit leads from a service box in the street opposite the lamp-post to a switch in the base of the post opposite the door. Within the conduit are three lead-incased, 40,000-circ. mil cables terminating at the switch base. The neutral is connected up directly with one lamp terminal and a single-pole switch is used to connect one of the outer wires to the other lamp terminal. The third wire is installed for emergency use. The switch is of the knife-blade type specially designed for this service and is connected

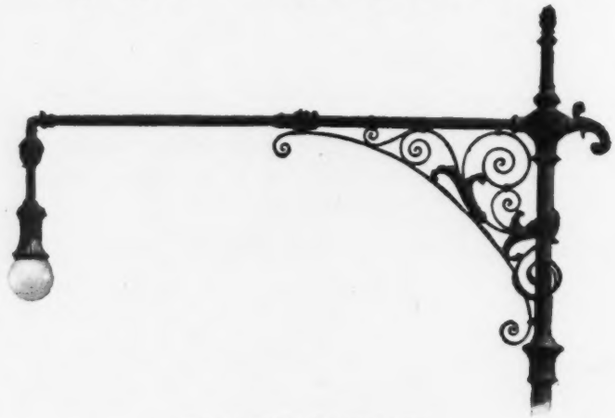


Fig. 7—Detail of Mast Arm.

Fig. 8—Detail of Fifth Avenue Cross-Piece.

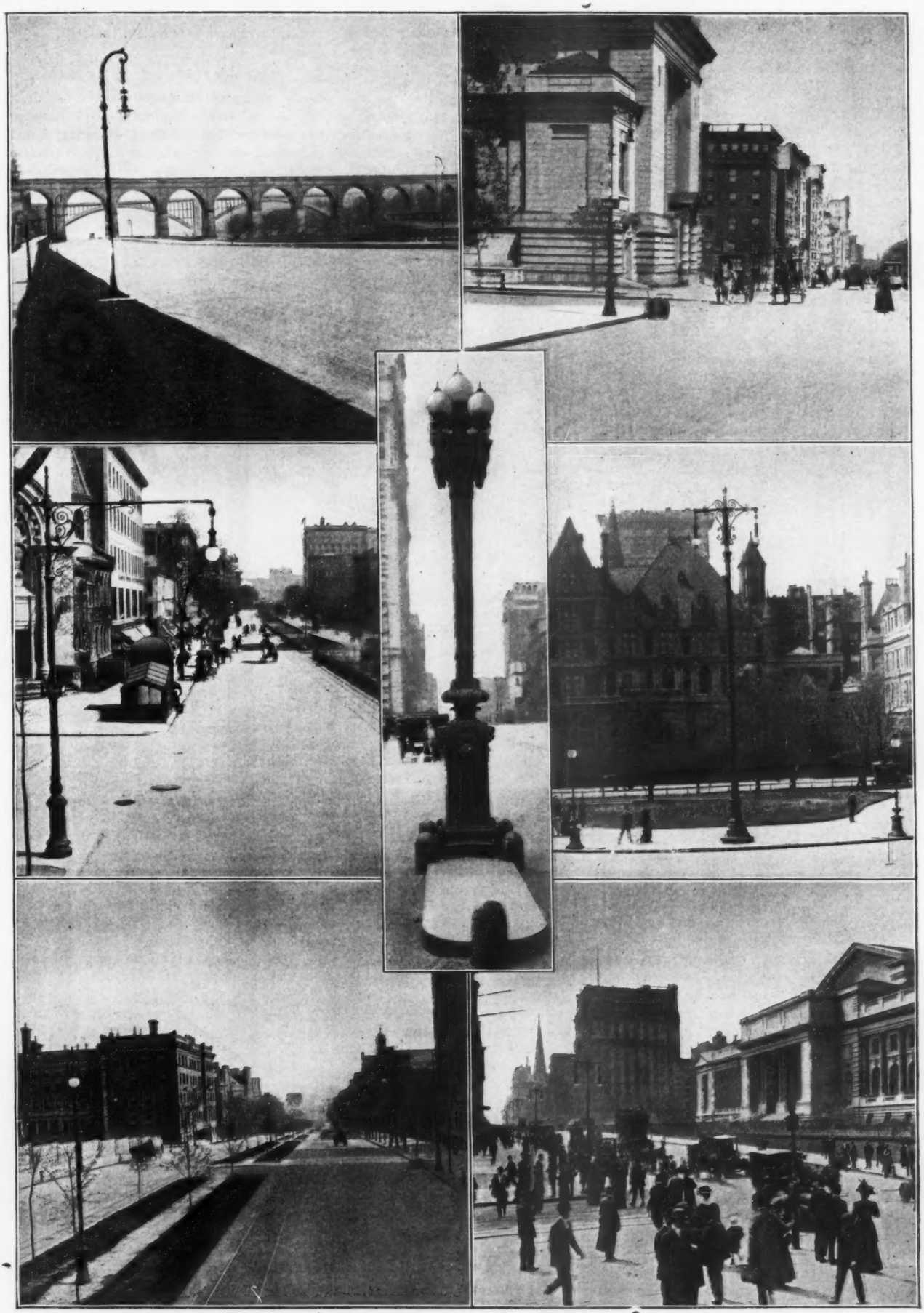


Fig. 9—Typical Installations of Arc Lamp-Posts in New York City.

in series with a 15-amp link fuse. From the switch to the lamp twin No. 10 rubber-insulated, double-braided wire is used. The lamp is fitted with a clear outer and an opal inner globe, except in the parks and parkways, where a clear inner and an opal outer globe are employed. Each lamp is controlled individually. The door in the base is fitted with a special socket lock and the switch is closed and opened at specified times by lamp lighters in the employ of the company.

The lamps are trimmed and cleaned weekly by a patrolman equipped with a special 18-ft. ladder fitted with hooks engaging the ladder arm on the post. The ladder is made of wood and weighs 29 lb. Once a year the posts are painted with a standard, copper-brown color specified by the Department of Water Supply, Gas and Electricity. Approximately 12 ft. above the sidewalk provision is made in the shaft for attaching the city street markers. These consist of square boxes maintained by the city and equipped with reflecting porcelain-enameled plates bearing street designations.

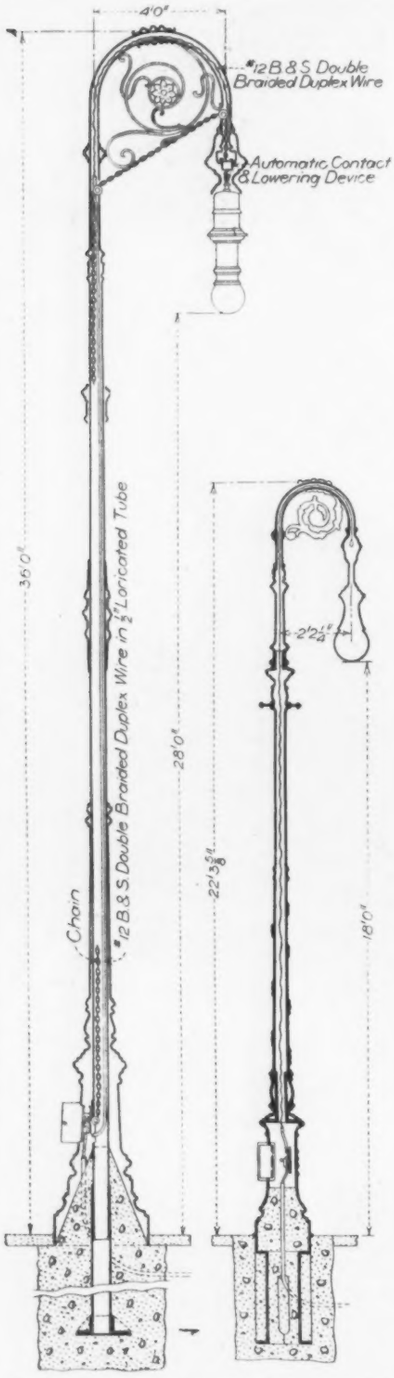


Fig. 10—Sectional Elevation of Flaming-Arc and Bishop's Crook Posts.

Fig. 11—Details of Shafts of Lamp-Posts in Various Designs.

Fig. 12—Flaming-Arc Post.

MAST-ARM POST.

Next to the bishop's crook the mast-arm post is the most widely employed. When considering the design of a mast-arm pole the officials of the New York Edison Company found many difficulties to contend with. Fundamentally, a mast-arm pole as commonly employed is an unsightly and ill-proportioned fixture. In this country there seems to have been no thought given to the design of this type of post, for it has always been constructed more from a utilitarian viewpoint than with any idea of beauty. Many sketches were made and skeleton poles rigged up with plaster models and wrought-iron scroll work so as to get an idea of the general proportions and the grouping of the various members which compose the present fixture. It took many months of study, changes of models and rearrangements of the decorations before the pole as it now exists was eventually completed.

For its sustaining member there is a steel tubular shaft of four sections swedge-jointed and 37 ft. over all. The two-piece 12-ft. extension arm is of similar construction and over both are applied, in the form of slip castings, the iron sections that go to make up the ornamental design of the post, the whole weighing

approximately 2000 lb. The base is a replica of the bishop's crook post, but on a larger scale, and the steel mast, which is necessary for strength, is ornamented with a fluted column which runs about half-way up the shaft. The bracket, to which most study was given and which required greater skill to design in order to get it away from the conventional bracket, is without doubt the most successful arrangement of scroll work and constructive lines that could possibly be designed. The scrolls, as will be noticed, radiate from a central husk which grows around the vertical shaft and is so designed that the scrolls appear to grow naturally from the central column. The main supporting member is composed of a reinforced wrought-iron scroll designed so as not to appear too conspicuous and yet suitable for the work. The horizontal arm, as will be noticed, is carried through the ornamental member by means of an ornamental cylinder which ends in a husk of acanthus leaves, and the finial or top member, an acorn surmounting the whole, gives the post a finished and well-proportioned appearance.

Fig. 13—Bracket.

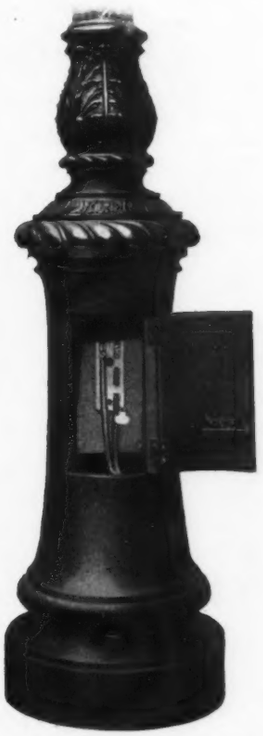


Fig. 14—Detail, Bishop's Crook Base.

The usual unsightly wires, ropes and other devices for lowering arc lamps have been dispensed with in the design described, the lamp being incorporated in the design of the post itself and suspended from a concealed hanger. The steel supporting member and arm can be reduced in size with a pipe cutter when the pole is in place, or shaped before installation, giving a post of flexible proportions and one that can be fitted to a selected location regardless of the overhanging tree limbs and without detriment to them. The ornamentation has been designed to adapt itself to extensive changes either in the shaft or in the arm, and to conform to them irrespective of change in their length, height or shape. The post is set in an excavation 6 ft. deep by 5 ft. square. In the special foundation of concrete is included at the time of its building a collapsible core box, paper-wrapped and plumbed, which is knocked down and removed after the mass solidifies, leaving a clear entrance, with a slight increase for the shaft, through the concrete to a cast-iron receiving flange at the bottom. The arm of the finished pole is 26 ft. above grade and the lamp is suspended 22 ft. above the roadway. The post is fitted with the same type of lamp as the bishop's crook, but these lamps are trimmed weekly and cleaned from a tower wagon, a single trimmer under these conditions caring for at least 200 lamps in a day. The individual control is exactly the same as that employed in the post previously described.

FIFTH AVENUE POST.

The poles along Fifth Avenue are made up of a fluted base and conventionalized Corinthian shaft with ornamental cap and double-arc lamp fixture composed of horizontal members supported by two decorative scroll brackets. The post is well proportioned and was specially designed for use on that thoroughfare. The base, which rests on a foundation similar to that for the bishop's crook post, rises 4 ft. 6 in. above grade and holds a 15 ft. 5 in. shaft surmounted by a crosspiece 6 ft. 3 in. high. The lamps are suspended 19 ft. above the sidewalk and each is controlled individually by its own knife switch. Direct-current lamps, fitted with clear inner and opal outer globes, are used. Looking down Fifth Avenue in the daytime one cannot but be impressed with the uniformity and happy proportions of these posts, and this is yet more evident in the nighttime when the lamps are lighted. The vista of these double-arm lamp-posts, stretching out as far as the eye can see, is without doubt a most attractive one from an esthetic point of view.

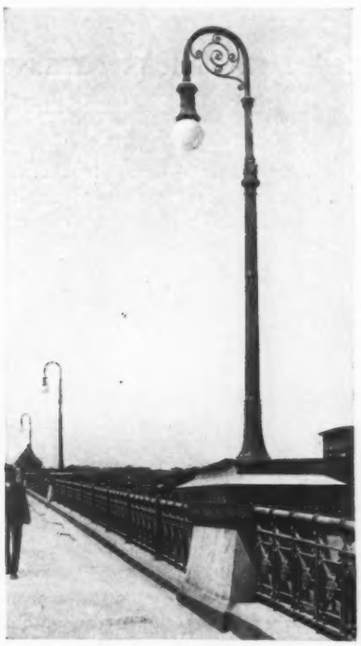


Fig. 15—Typical Bridge Installation.

LYRE-TOP POST.

The lyre-top post is installed in the narrow parkway dividing the roadway of New York's wide avenues. It is 23 ft. high, but is not of as massive proportions as the mast-arm post used on the same thoroughfares, and differs from it in that it is entirely of cast iron in three sections. The base and shaft are identical with that of the bishop's crook post, the only difference being in the top piece. This is of ornamental cast and wrought iron patterned after a lyre, in the center of which the lamp is suspended. The design of the lyre is complete only with the lamp and is of such proportions that it does not cut off any of the light. No direction is given to the lamp at its point of suspension and its location in the center of the parkway is of great advantage in that it has a distribution unaffected at any angle by intervening obstructions. The lamp is fitted with an outer globe of very light opal glass with a clear inner globe, this combination having been found to give the best diffusion and correction as to color without too large a sacrifice of illuminating efficiency.

FLAMING-ARC LAMP-POST.

The design of the flaming-arc lamp-posts is similar to that of the mast-arm post, with the exception that the shaft is longer

and fitted with a crook harmonizing with the rest of the design. The details of this post are given in one of the engravings. The lamp is lowered for cleaning and electrodes by the trimmer, who hooks a special rope to the chain fastened to the lowering device. Within the tube the wires are inclosed in a ½-in. loricated tube to protect them from abrasion by the chain. On poles of this type flaming-arc lamps with converging electrodes are employed. The twin flaming arcs shown in one of the engravings are of the Blondel type, and in both types of lamps flaming electrodes giving a white light are used.

The various details of ornamentation are clearly shown in the engravings reproduced herewith, and the general appearance of the posts on the streets of the city is shown in the group engraving, the center picture showing an isle of safety at Times Square. The illustrations portray better than words the actual appearance of the posts and how well they harmonize with their surroundings.

RECENT TELEPHONE PATENTS.

IMPROVED AUTOMATIC AND SEMI-AUTOMATIC SYSTEMS.

Originally automatic working required that all subscribers of any system be interconnected at a single central switching station. When a large territory was served this resulted in an excessive wire mileage. As a means of reducing this wire mileage to normal sub-switching stations have been introduced. At these substations a local group of subscriber lines is centered and sub-switching devices there associate the lines as required with trunks extending to the main switching center.

Mr. C. R. Austin, of Long Beach, Cal., has arranged a semi-automatic system along these lines. He provides a manual switchboard at the main center and automatic switches at the sub-centers. Upon the initiation of a call at any subscriber station, the automatic switches at the sub-center operate to select an idle trunk to the main center, there to be displayed in a lamp signal before the operator. The operator responds in the usual manner by means of connecting cords. Before the operator is the usual jack multiple, corresponding jack by jack to the line numbers of the system. Upon learning the desired number the operator completes the connection to the multiple jack. This automatically initiates operation of an automatic selector to select an idle trunk to the proper sub-center and there to select the desired line.

Three patents have recently been granted to Mr. A. H. Dyson, of Chicago, for automatic systems, all of which are assigned by him to the Kellogg Switchboard & Supply Company. All relate to that type of system wherein a master switch is employed. This switch serves to cause the operation of a line selector to seek out the calling line and connect it with a first selector preparatory to setting up the desired connection.

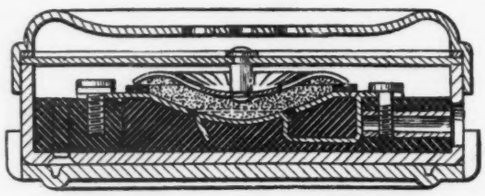
One of the patents provides for a printing attachment associated with the line selector. As this selector always assumes a fixed and different position for each calling line, it may readily be arranged to set up a type-wheel in position to print the calling number. The actual printing or impression occurs with the response of the called subscriber. It will be seen that a method of registering calls is thus provided, it being necessary to count the number of impressions of each number upon the various printed slips.

A second of these patents provides a master switch which will respond to successive calls one after the other without the necessity of awaiting the completion of one connection before responding to a succeeding call. Thus the master switch delays for each arriving call only sufficiently long to pick out and start the line selector.

The third Dyson patent provides a locking device for the line relays of the master switch. This is so arranged that when a call is initiated the line relay is locked until the call has proceeded to a point where none of the switches will be hung up if an attempt be made to stop it. Further, the control of the connection is left with the calling party until the called party answers. It is then shifted to the called party. This provides for knocking down a connection where the called party fails to respond.

NEW APPARATUS.

The accompanying illustration shows the section of a transmitter designed for the use of the deaf. The rear electrode is dish-shaped and consists of two insulated portions, a middle part and a surrounding ring. It will be seen that the front electrode is shaped correspondingly and it is made particularly flexible by being cut with numerous radial slits. The



Babcock Transmitter.

transmitter is designed to operate in any position. It is mounted upon a metal base plate which also provides a seat for the receiver or earpiece. A circuit closer is provided which maintains the circuit open whenever the receiver is placed upon the base plate. This apparatus is the invention of Mr. G. Babcock, of Rochester. The patent has been assigned to the Simplex Telephone Equipment Company.

A patent granted to Mr. B. F. Gardner, of Chicago, describes a novel disinfecting device. The disinfecting means consists of a series of electric sparks or discharges within the mouthpiece of the transmitter. Spark terminals project through the walls of the mouthpiece, being connected with a secondary coil wound upon the ringer frame. When the alternating ringing current is sent out on the line to ring the bells the secondary coils cause the generation of sparks.

A receiver holder has been patented by Mr. H. M. McAlarney, of Puritan, Pa. The novelty lies in a cam device, operated by a thumb nut, which serves to lock the hook lever when the telephone is not in use.

LETTERS TO THE EDITOR.

The Components of Alternating Current, Electromotive Force and Power.

To the Editor of Electrical World:

Sir:—In your issue of Nov. 24, page 1244, Mr. C. O. Mailloux emphasizes the desirability of uniformity in naming the two components of curent, e.m.f. and power, in an alternating-current circuit. The adjective "reactive" well designates one of these components, the so-called wattless component, as discussed in your editorial, page 1213, and has the advantage of consistent and continuous use since the term "reactance" was first defined. (See paper on "Reactance," by Steinmetz and Bedell, *Transactions* A. I. E. E., Vol. XI, page 640, 1894.) Furthermore, the term "effective" also designates very well the other component, the power component, and this word, too, was in early use. (See, for example, Figs. 14, 50 and 51, Bedell and Crehore's "Alternating Currents.") Unfortunately, however, the term "effective" is often used to designate the square root of mean square or virtual value of an alternating quantity, and if "effective" is to be permanently adopted in this latter sense it should not also be used to designate the power component.

A suggestive word to designate the power component is "active." Thus, active current, active electromotive and active power furnish the activity or useful power of a circuit as distinguished from the reactive current, reactive e.m.f. and reactive power, which do not furnish useful power. The words "active"

and "reactive" would no doubt appeal to French writers, since the term "reactance" originated in France, Prof. Hospitalier and Prof. Blondel both being instrumental in its introduction.

In regard to the word "apparent," its use in the way suggested in your editorial may lead to misunderstanding. The word is already overworked in technical writing; furthermore, it has a definite non-technical significance and it would be confusing to give it any other than its apparent meaning. "Apparent resistance" might, for example, be taken to mean impedance, or to mean the true resistance (measured by direct current) plus the increase due to skin effect, or the true resistance (as of a transformer primary) plus the apparent increase due to the secondary, or to mean the equivalent resistance of a combination of circuits, or to mean total copper (RI^2) losses divided by the square of the current, etc. In the case of power the combination of the active power and reactive power may correctly be termed the apparent power, as is now commonly done, for "apparent" then has its usual popular meaning. In the case of "e.m.f." and "current," however, no such qualifying word seems necessary, the combination of the active and reactive e,m.fs. being the total e.m.f., or merely *the* e.m.f., and the combination of the two components of current being the total current, or *the* current.

Ithaca, N. Y. FREDERICK BEDELL.

Voltage-Wave Distortion and the Life of Incandescent Lamps.

To the Editor of Electrical World:

SIR:—The article by Prof. Kinsloe in your issue of Nov. 17 points to conclusions which, if substantiated, are of very great practical interest. In view of the commercial and engineering importance which would necessarily attach itself to a definite discovery of an influence of wave form on the life of other lamps than tantalum lamps, it is unfortunate that Prof. Kinsloe's presentation of his results is not more conclusive. As you have said editorially, the results which he has found are contrary to expectation. For this reason it is very important that the presentation of the results should be full and complete, including every necessary datum to enable the reader to form his own judgment as to their reliability.

A number of data are omitted from Prof. Kinsloe's article which it seems to me are essential to forming a reliable judgment of the results. For instance, we know that comparative tests made on incandescent lamps are in general worthy of very little credence unless they are made upon a rather large number of lamps. The larger the number of lamps involved the more likely is the comparison to be a valid one. Prof. Kinsloe states that his tests were made with a large number of lamps, a statement which is entirely too indefinite, since Prof. Kinsloe's idea of what constitutes a large number of lamps may be quite different from that of those readers who, for instance as manufacturers or as central-station officials, are accustomed to dealing with lamps by the thousands or millions, and who are the ones whose interests are most closely concerned with any effect such as Prof. Kinsloe claims to have found. Those familiar with the unavoidable variation in life-test results, even when made by people with long experience in this class of work, under the best conditions, with closely regulated current and a high class of photometric equipment, realize better than anyone else that the comparative tests of an insufficient number of lamps are of negligible value, except as pointing out effects of such magnitude that they are unmistakable.

The conditions under which the tests were made are not sufficiently well explained. For instance, it is not stated whether the lamps were burned on life test at their normal voltage or normal watts, or just how. It is not stated whether the photometric measurements were made on alternating current or direct current and whether the lamps while being photometered were burned at normal volts, or under what other condition they may have been burned. Nor is it stated how the watts of the lamps were measured, whether on direct current or on alternating current, and, if the latter, with what kind of an instrument. Also, the frequency of the alternating current is not stated.

The statement is made that the tests were carried on until the filaments were broken or to the "smashing point." Here, again, Prof. Kinsloe does not state what he understands by the "smashing point"; whether it is the same as the point at which the filaments are broken and therefore measures the ultimate life of the lamp, or whether he means some other point, as is commonly the case. If some lamps were taken to the end of their ultimate life and others to an arbitrary "smashing point," it would seem that these two classes of lamps should be differentiated in the article.

Inasmuch as the results contain certain apparent anomalies, which to those who are accustomed to the more antiquated views regarding incandescent lamps are difficult to understand, all of the above data are of importance in enabling one to form a judgment of the results. As to the anomalies mentioned, it may be noted that in the case of all of the carbon, graphitized and tungsten lamps the initial candle-power was higher on the sine wave than on the peaked wave, and that the watts per candle of all were lower on the sine wave than on the peaked wave, with the exception of the 25-watt tungstens and the 100-watt tungstens, in which latter case the watts per candle were the same on both wave forms. In the lack of any more definite information, it seems right to infer that this is the difference which is referred to in Prof. Kinsloe's paper where he says, "A marked difference in the performance of the groups of lamps subjected to the two waves was at once observed and it continued throughout the tests." In Prof. Kinsloe's paper as printed in the Bulletin of the Pennsylvania State College the further statement is made: "In fact, the lamps of all types and sizes exhibited at the start a decided advantage in favor of those on the sine wave." It seems right to assume that these statements refer to the higher candle-power and lower watts per candle of the lamps on the sine wave.

Now, it is very hard to see what these statements mean. Certainly lamps can be burned at the same watts per candle on peaked wave that they can on sine wave. That is only a question of the voltage. Certainly lamps can be made to give as much candle-power on peaked wave as on sine wave. That is also a matter of the voltage. If two lamps which are supposed to be exactly alike, are operated one from sine wave and the other from peaked wave, and are found at the same voltage to give different candle-power and different watts per candle, the natural inference is either that the measurements are in some particular incorrect or that the lamps are not alike.

Prof. Kinsloe says that he used a large number of lamps in his tests, and presumably he divided his test lamps at random into two groups, one for the sine-wave tests and the other for the peaked-wave tests. If he did not do this, his results are not comparable. If he did do it, how is the fact that the candle-power of the lamps in one group was persistently high and their watts per candle persistently low to be explained? Until this important point is cleared up the results of the life test are necessarily under suspicion.

Let us now look at some of the collateral evidence regarding the existence of this effect which Prof. Kinsloe's results point to. There would seem to follow as a necessary corollary the statement made in your editorial in which you say, "However, it is difficult to conceive of any effects attributable to the substitution of a peaked for a sinusoidal e.m.f. wave that would not be found when either an alternating e.m.f. was substituted for a unidirectional e.m.f. of the same effective value, or a high-frequency e.m.f. was substituted for an equal low-frequency one."

Tests to determine the relative life of carbon lamps on direct current and on 25-cycle and 60-cycle sinusoidal current were made at the Electrical Testing Laboratories in 1905. In these tests a total of 150 lamps were used, which were divided

into three groups of fifty lamps each, every effort being made to secure groups which would be comparable in point of date of manufacture, voltage, candle-power and efficiency. The results of these tests were as follows:

Taking the average effective life of the 60-cycle lamps as 100 per cent, the life of the lamps on 25 cycles was 104 per cent and that on the direct current was 94 per cent. These results were at that time, and are still, considered as inconclusive as far as pointing out differences in the life of carbon lamps on direct-current and alternating-current circuits is concerned, the observed differences being attributed to the differences in individual lamps and to the necessarily somewhat different regulation of the different generators. Howver, what difference between direct-current and alternating-current tests is shown is directly contrary to what would be expected from Prof. Kinsloe's results.

Another experiment made by the Electrical Testing Laboratories may have some bearing on this question. At one time the life-testing arrangements were changed from a 133-cycle peaked-wave generator to a 60-cycle sine-wave generator. An attempt was made at that time to establish any systematic differences in the life of the lamps produced by this cause. The results gained were inconclusive. The wave form of the peaked-wave generator showed a third harmonic 20 per cent of the fundamental, whereas the sine-wave generator showed a third harmonic 4.7 per cent of the fundamental. The peak of the one machine was 18 per cent higher than that of the other for the same mean effective value. Unless it can be urged that the higher frequency of the peaked-wave machine masked the effect of the peaked-wave form, this test would seem to furnish negative evidence with regard to Prof. Kinsloe's results. That the frequency does not seem to have an influence on the life of carbon lamps is indicated by the results of the previously cited test.

Tests made on the earlier makes of tungsten lamps on direct current and on alternating current indicated quite positively that no difference in their life was to be expected. These indications were so clear that, in the absence of anything to arouse suspicion to the contrary, the Electrical Testing Laboratories has not made similar tests on modern tungsten lamps. The ordinary squirted tungsten filaments which have been burned for 1000 hours on alternating current do not show under the microscope any obvious cause for failure such as the faulting which is so characteristic a feature of tantalum filaments which have been burned on alternating current. This piece of negative evidence indicates that if the life of the tungsten lamp is really shorter on alternating current than on direct current the shortening is for some other reason than that which affects the tantalum filament. In the case of tantalum lamps the effect of alternating current is well known, having first been demonstrated, I believe, at the Electrical Testing Laboratories. The greater destructiveness of the peaked wave may be due to the triple-frequency harmonic. The destructiveness ought to be practically the same, if the phase of the triple-frequency harmonic were reversed. A test made in this way would undoubtedly be very interesting, since it would differentiate between the frequency effect and the temperature effect.

In view of all the facts of the case, the necessity for the strongest direct and collateral evidence to substantiate any such unusual results as Prof. Kinsloe has presented is clearly apparent, and the necessity for suspending judgment as to these results until more complete data are at hand cannot be too strongly urged.

New York. Clayton H. Sharp.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Field of the Induction Motor.—C. F. Smith.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers on the irregularities in the rotary field of the polyphase induction motor. The author describes a number of experiments to determine the extent of this irregularity by measurements of the e.m.fs. induced in special search coils wound on the stators of two induction motors, so as to embrace portions of the air-gap flux of the motors. These search coils were disposed in various positions round the stator and were wound so as to embrace different numbers of stator teeth. One of the results is that the resultant voltage induced by field irregularities in several windings connected in series bears very little relation to the voltages of the individual windings and is in general much smaller. This effect can be shown to be due to the fact that there are always voltages induced in some coils which are in direct opposition to those being simultaneously generated in others. This result is not without practical importance, since it has a direct bearing on the question of wound rotors versus squirrel-cage rotors for short-circuited induction motors. For example, in one case a pulsation e.m.f. of 9.5 volts was induced in the coil wound in a pair of slots having a pitch equal to that of the poles of the motor. This corresponds to nearly 1 volt per turn at the normal voltage. If such a coil were directly short-circuited on itself, as would virtually be the case in a squirrel-cage motor, probably a considerable current of high frequency would be obtained which would not contribute to the torque of the motor. By connecting in series the conductors in several slots, the resultant voltage due to irregularities of the field is much decreased, while at the same time the impedance of the circuit in which this voltage acts is largely increased. The pulsating currents and the heating due to them may thus be reduced to a relatively small value in a wound rotor. On short-circuiting the rotor winding of the induction motor under consideration, while driven at synchronous speed, the slip-ring current was found to have a value of less than 1 amp, although the open-circuit slip-ring e.m.f. was over 4 volts. The damping out of high-frequency voltages in the rotor winding depends less on the number of slots per phase than on the relation existing between the spans of the several coils. The same consideration will govern the extent to which the effects of "cogging" will make themselves felt when full speed has been obtained.—Lond. *Elec. Eng'ing*, Nov. 17.

Commutator Alternators.—R. van Cauwembeghe.—If a shunt-wound commutator motor for single-phase current (Fig. 1) shall be able to excite itself and to work as a generator it must be possible, by connecting it to an alternating-current network of suitable frequency and voltage and by mechanically driving it, so to regulate the speed and the number of excitation turns *bc* that the current in the network becomes exactly zero. The author made this experiment with a small motor and was able to reduce the current in the network to a sharply defined minimum for a certain number of excitation turns and for a speed near synchronism, but he could not reduce the cur-

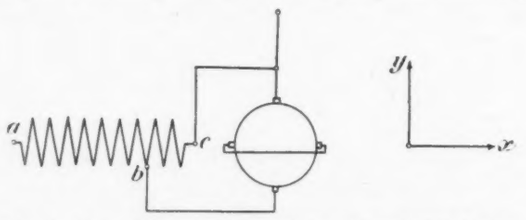


Fig. 1—Shunt-Wound, Single-Phase Commutator Motor.

rent in the network to zero. This is explained by the fact that the voltage curve in the network contained higher harmonics. With these the motor did not run in synchronism when the current was a minimum. The motor was, so to speak, short-circuited for these higher harmonics and, therefore, consumed relatively high short-circuit currents. This was proved to be true by means of the oscillograph and it was shown that the current consisted of higher harmonics only and that the fundamental wave had really been reduced to zero. This proves that the machine is able to generate its own exciting current for the fundamental wave, but not for the higher harmonics. Thus the conclusion may be drawn that when the generator is disconnected from the network its voltage curve would be a pure sine wave free from higher harmonics. This was, indeed, found to be true by experiment. The author investigates this property of commutator alternators mathematically and discusses the conditions when the generator is loaded and when it is unloaded. The behavior of the commutator alternator when loaded shows the necessity of compounding. This may be easily accomplished if in each exciting circuit an additional voltage is produced which compensates the ohmic voltage drop.

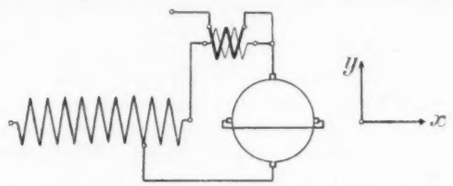


Fig. 2—Compound-Wound, Single-Phase Motor.

Fig. 2 shows the arrangement used by the author for a single-phase machine. The x current (load current) passes through the primary of a transformer provided with an air-gap, the secondary of which is inserted in the y rotor phase. The compounding voltage is displaced by 90 time-degrees against the load current, but it does not act directly on the x phase of the rotor, but on the y phase. The latter transmits the voltage to the x phase with a displacement of 90 time-degrees. A test of this machine from no-load to full-load showed a voltage drop of 1 per cent for unity power-factor and a voltage drop of 6 per cent for a power-factor of 0.3. The frequency remained exactly constant. The generator was very little saturated. Finally the author sums up the advantages and disadvantages of the commutator alternator as follows: The disadvantage is the commutator. Advantages are that no outside exciter is required; that only a few more ampere-turns are required on the rotor than on the stator (instead of twice or three times as many); that the rotor need not be highly saturated; that there is no possibility of such enormous short-circuit currents as occur with turbo-generators of ordinary construction where they may become twenty or even thirty times the normal current; that a simple and exact compounding method is available; that the voltage current is sinusoidal for any load; that no difficulty is experienced in parallel connection.—*Elek. u. Masch.* (Vienna), Nov. 6.

Interpole Converter.—P. M. LINCOLN.—A comment on the A. I. E. E. paper by Messrs. Lamme and Newbury, noted in our issue for Nov. 17, with special reference to the use of commutating poles with high-voltage synchronous converters. It has been found by actual experience that the voltage between adjacent bars in the synchronous converter should be kept below a certain value, which is dictated not so much by commutating conditions as by a tendency toward flashing on heavy loads and short-circuits and by the fact that the insulation between bars is apt to be injured if a certain maximum voltage between bars is exceeded. Having fixed a maximum allowable voltage between bars, the maximum direct-current voltage that it is possible to obtain from a given synchronous converter is merely a matter of the frequency applied to the converter, and the minimum possible width of the commutator bars and the maximum possible commutator speed that can be used successfully. A given commutator bar must pass from one brush to the next adjacent one in half a cycle. Assuming, for example, a commutator speed of 5000 ft. per minute, this consideration makes the distance between adjacent brush arms 20 in. in a 25-cycle converter and 8 1/3 in. in a 60-cycle machine. If it be assumed 3/16 in. is the minimum that can be occupied by a commutator bar and its insulation, the limit is at once placed at 106 bars betweent adjacent brushes in the 25-cycle converter and forty-four bars for the 60-cycle. Assuming further that 15 volts is the limiting e.m.f. between bars, the conclusion is reached that 1590 volts is the limiting e.m.f. for a 25-cycle converter and 660 volts for a 60-cycle machine. The only way to increase the direct-current voltage is a higher commutator speed, a thinner bar or a higher voltage between bars. Previous practice has shown that the limits mentioned above cannot be very much exceeded. Further, from the necessity of limiting voltage between bars for reasons other than commutation, it follows at once that the commutating characteristics of the high-voltage converter will in general be even better than those of the low-voltage machine because there is less current to be reversed in the coil passing under the brush and the self-induction of the coil will not be materially increased for the reason just mentioned. Apparently, therefore, there is no necessity of using interpoles on synchronous converters simply because they are high-voltage machines. It is questionable, therefore, whether the interpole will ever be used in synchronous converters to the some extent that it is used on direct-current machines, and, further, the conditions which demand its use, such as higher speeds, larger outputs per pole, etc., must exceed anything demanded at present before it will be used at all.—*Elect. Journal*, December.

Train-Lighting Generator.—A note on a recent British patent (16,447, Nov. 10, 1910) of A. H. Midgley and C. A. Vandervell. A reversible, self-regulating generator has the brushes in the normal position relatively to the main poles, which are not excited. Auxiliary wound poles are provided in the commutating zone, and induce heavy currents for the short-circuited coils. These local currents set up a cross-magnetizing flux which distorts the inducing flux into the main poles and thus causes an e.m.f. to be generated into the working part of the armature winding. The distortion will be in one direction or the other, according to the direction of rotation, and consequently the current taken from the brushes will always be in the same direction. As the reaction of the working current is exactly opposed to the inducing poles, the output of the generator will remain practically constant at all speeds.—Lond. *Elec. Eng'ing*, Nov. 17.

Frequency Changer.—A note on a recent British patent (24,126, Nov. 10, 1910) of the British Thomson-Houston Company (General Electric Company of this country). A synchronous double-current alternator or frequency changer comprises a machine with a single armature and field system. The armature has coils forming two windings of different pole numbers, and the field system has two component m.m.fs. corresponding in pole numbers to the two pole numbers of the armature. The voltages of the two currents generated may be varied independently. When running as a frequency changer with a constant voltage on the motor side, the voltage on the generator side may be varied.—Lond. *Elec. Eng'ing*, Nov. 17.

Compounding of Alternators.—P. NOEL.—The conclusion of his article on different methods of compounding alternators. In the present instalment brief descriptions are given of the following methods, together with diagrams: Boucherot, Delamont and Herdt, Rice, Blondel, Union Electric Company, Roth, Leblanc, Heyland, Walker, Dolivo von Dobrowolsky, Crompton, Seidner, La Tour. Finally the regulators of Blathy, Dick, Thury, Dalemont and Herdt, Thieme, Routin, Tirrill and Schwaiger are described and illustrated.—*L'Industrie Elec.*, Nov. 10.

Polyphase Commutator Motor.—L. DREYFUS AND F. HILLEBRAND.—The conclusion of their paper on the theory of the three-phase commutator shunt motor. In the present instalment the authors discuss the arrangements for self-compensation and finally give a numerical example.—*Elek. u. Masch.* (Vienna), Nov. 6.

Lamps and Lighting.

Street-Lantern Support for Metallic-Filament Lamps.—A note on a recent British patent (23,980, Nov. 3, 1910) of H. T. Harrison. In an anti-vibration support for metallic-filament lamps in street and other lanterns the lampholder is provided with a metal flange, and this is supported inside an insulating hood of inverted cup shape by means of three or more spiral springs arranged radially and horizontally between the flange and the hood. Two or more such supports may be fixed together to form a group fitting.—Lond. *Elec. Eng'ing,* Nov. 10.

Generation, Transmission and Distribution.

Bulk Supply from Large Generating Plant.—S. Z. de Ferranti.—His presidential address before the (British) Institution of Electrical Engineers. He proposes to transform all the energy of coal into electrical energy and to use this electrical energy for all purposes for which coal is used at present. To make this an effective system the heat conversion efficiency should be at least 25 per cent. This is possible with gas engines fed from gas producers. The by-products should be recovered at the same time. The scheme would be carried out in a comparatively small number of large generating stations. He figures the capital cost of generating works at $35 per kilowatt and the cost of the distribution system at $65 per kilowatt. Capital costs taken at 8.5 per cent would amount to 0.1552 cent per kw-hour and works costs are figured at 0.072 cent, bringing up the total cost to 0.2290 cent per kw-hour. The average price of the coal is assumed as $2.50 per ton. Further, it is assumed that one ton of coal will yield fixed nitrogen equivalent to 1 cwt. of sulphate of ammonia. He suggests the average price at which energy would be supplied throughout the country would be 0.25 cent per kw-hour, and sketches the effect which such a low cost would have on electric lighting and electric traction and on the use of the electric furnace for the manufacture of pig iron, aluminum, etc. He finally outlines the uses of the by-products, namely, fixed nitrogen in the form of sulphate of ammonia, together with tar and oils.—Lond. *Electrician,* Nov. 11.

Hydroelectric Plant in Baden.—An account of the proposed development of the Murg water-power in Baden, Germany. According to the plans of the railroad department of Baden there will be twelve turbo-generators, six of 4400-hp and six of 5000-hp maximum rating. Three-phase currents are to be generated at 10,000 volts. This e.m.f. is to be employed for distribution in the neighborhood. For transmission to greater distances the e.m.f. is to be raised to 70,000 volts. The power plant is to be built, operated and maintained by the railway department, which has already three steam-driven plants having an aggregate rating of 7800 hp.—*Elek. Zeit.,* Nov. 17.

Energy for Rolling Mills.—J. A. Knesche.—An article on the energy required for the rolling of iron and steel based on experimental tests. In the first instalment arrangement of the tests is described and the influence of temperature on the rolling of steel is discussed, with notes on pyrometers suitable for such work. In the second instalment the test data are tabulated and analyzed.—*Eng. Mag.,* October and November.

Traction.

Direct-Current Versus Single-Phase Traction.—H. M. Hobart.—A paper in which the author gives in considerable detail an estimate of the cost of a direct-current and a single-phase system for a typical case of railway. His final result is that the total cost per train-mile would be 37.6 cents for continuous current and 44.6 cents for single-phase. "The less frequent the trains the lower the speed, and the greater the distance between stops the less unfavorable to the single-phase system will be the results of such a comparison, but the less also is then the desirability of employing electricity, and by the time the point is reached where the single-phase system as at present developed is more economical than the continuous-electricity system the conditions are such that (except for very special cases) steam-locomotive operation constitutes the most economical system."—Lond. *Elec. Eng'ing,* Nov. 10.

London Underground Railways.—A detailed analysis of the cost of operation and earnings of the different underground railways of London during the past twelve months. With one exception there is a very satisfactory increase in the number of passengers, but the average revenue per passenger on all the tube lines shows a tendency to decrease. The Central London Railway shows a considerable increase in total working expenses, which are now 11.0 cents (against 10.20 cents last year) per car-mile—forty-eight passengers per car. This increase is distributed over a number of items, but repairs to permanent ways and cars, lift working, general charges and rates and taxes show an increase of 0.74 cent per car-mile. The last-mentioned item—namely, rates and taxes—appears to become an increasing handicap. Thus, these charges now amount to no less than 2.12 cents per car-mile. The cost of electric energy per car-mile has decreased by 0.2 cent. The City and South London tube has the low expense of 5.8 cents per car-mile (thirty-two passengers per car), which result is only surpassed by the 10.7 cents per car-mile (sixty-three passengers per car) of the Great Northern & City Railway.—Lond. *Electrician,* Nov. 11.

Gearing for Automobiles.—F. W. Lanchester.—His presidential address to the (British) Institution of Automobile Engineers. He thinks that the change-gear box is the weakest point in the chain of the mechanism of the modern automobile. The most promising alternatives to mechanical change gear up to the present proposed or utilized are: (a) hydraulic transmission, (b) electrical transmission and (c) electrical auxiliary. When one of the first two is employed it may either be arranged as a direct substitute for the change-gear box or may be made to operate direct from motor to road wheels, thereby doing away with the right-angle drive (bevel or worm) and even the differential. Both arrangements possess advantages and corresponding disadvantages. But the hydraulic system is superior to the electrical one, especially with respect to efficiency. He thinks an electric transmission system could never come into use except in exceptional cases, but that there are much better prospects for the third alternative, the electric auxiliary. He concludes that whether the gasoline-electric auxiliary system shall have a wider application than is now in contemplation must rest largely with the question of accumulator weight, not the weight per hp-hour—that is, the energy content—but rather the horse-power output—that is, the rate of doing work.—Lond. *Electrician,* Nov. 11.

Installations, Systems and Appliances.

New Home of British Institution of Electrical Engineers.—An illustrated article giving some details of the electrical equipment of the new home of the (British) Institution of Electrical Engineers on the Victoria Embankment in London. The lighting equipment of the lecture hall is divided into two main sections, that above the lay-light and that on the cornice. The former consists of four mercury-vapor lamps and the latter of 220 25-watt osram lamps fixed in channels of fluted glass round the cornice. These illuminate indirectly. Each alternate plug on this series is supplied from a separate circuit, there being ten circuits in all. The lighting of the hall is controlled by two sets of three two-way switches.—Lond. *Electrician,* Nov. 11.

Electrical Equipment of Post Office.—An illustrated description of the new generating station of the General Post Office in London, which supplies three-phase energy at 6600 volts to substations in the main post-office buildings in the city where the e.m.f. is lowered for lighting and motor service and for charging telephone batteries.—Lond. *Electrician,* Nov. 18.

Auto-Transformers.—W. W. Lewis.—The author first discusses with the aid of diagrams the fundamental principle of the auto-transformer, sometimes called a "compensator." He then discusses briefly house auto-transformers and auto-transformers for signs, arc lamps, mercury-arc rectifiers and motor starters.—*Gen. Elec. Review,* December.

Balancers for Three-Wire Networks.—G. SALZMANN.—A mathematical article illustrated by diagrams discussing the fundamental principles on which a motor-generator balancer operates in a three-wire system.—*La Lumière Elec.*, Nov. 12.

Wires, Wiring and Conduits.

Stress and Sag in Overhead Wires.—R. WEIL.—According to the standardization rules of the German Association of Electrical Engineers the determinations of stress and sag in overhead wires require a double calculation. One calculation is based on a temperature of —20 deg. C. without any additional load. The second calculation is based on a temperature of —5 deg. C. and an ice load. In the latter case the weight of the ice is assumed as 0.015 q kg per meter, where q is the cross-section of the conductor in square millimeters. In some cases the maximum stress is found by the first calculation, in other cases by the second. The present author gives simple formulas which show for which of the two calculations the maximum stress will be obtained. The calculation of the maximum sag is also given. The chief figures needed in the calculation of overhead wires are compiled in the form of tables, and the results are explained by means of diagrams and examples.—*Elek. Zeit.*, Nov. 17.

Electrophysics and Magnetism.

High-Tension Discharge.—E. WILSON AND W. H. WILSON.—A paper read before the London Physical Society on a new method for producing high-tension discharges. The method is the same as that described by the authors in their British Association paper, recently noticed in the Digest. According to this method energy is taken from an alternating-current or continuous-current source and is stored in a magnetic field by an inductance; it is then permitted to surge into a condenser which, with the inductance, forms a low-frequency oscillating circuit. When the energy is stored in the condenser the latter is mechanically bridged across the primary winding of a spark coil, with which it forms a high-frequency oscillatory circuit. The energy is then transmitted by the secondary winding of the spark-coil to the work circuit in the well-known manner.—Lond. *Electrician*, Nov. 11.

Dielectric Properties of Pure Vaseline.—An experimental account of dielectric anomalies during change of state of an insulating medium. Pure vaseline, which is an insulator at ordinary temperatures and a conductor when in the liquid state, acts at intermediate temperatures as a medium charged with free ions of opposite signs, whose mobility, which is nothing when the substance is semi-fluid, is only indicated when liquid portions appear.—Lond. *Electrician*, Nov. 18.

Electrochemistry and Batteries.

Heating and Cooking Apparatus.—A note on a recent British patent (23,818 and 23,819, Nov. 3, 1910) of G. G. Bell and J. V. Pletts. These patents relate to cooking apparatus in which the heat is stored up in an isolated body of material and conducted away when required. According to the first specification water pipes are embedded in the heat-storing body and form a closed circulating circuit with pipes placed in an oven either inside or adjacent to the body. The latter pipes are arranged helically to form one or more hot plates on which the cooking utensils can be placed. The heating element is embedded in the heat-storing body, but an additional element may be placed in the oven. The second specification describes an electric oven with a vent pipe for allowing the products of ebullition to escape. Special utensils are employed, each having a pipe or vent in the lid communicating with the outlet.—Lond. *Elec. Eng'ing*, Nov. 10.

Units, Measurements and Instruments.

Electric Testing of Water.—An article on an electric apparatus designed by Digby and Biggs for the testing of water. It is based on the fact that the conductivity of water is a good indication of the degree of its hardness. The apparatus consists of a glass U-tube, the bend of which is connected with a drain pipe of rubber closed by a pinchcock, and to a third vertical tube ending in a funnel for filling. An electrode consisting of a ring of platinum strip is fixed at the top of each arm of the U-tube. The tube, after being washed out, is filled with the water to be tested and the electrodes are connected by a twin-flexible and plug to a sealed box containing a direct-reading conductivity meter and a hand-driven direct-current generator. This machine generates at 100 volts, when the speed of turning is such that the clutch is felt to slip and the meter then reads directly in conductivity units (the reciprocal of megohms). By giving the electrodes a large surface and using a long tube variations in conductivity due to gas bubbles on the electrodes are practically eliminated. The back e.m.f. of polarization (about 2 volts) is allowed for in making the scale. As the conductivity varies with the temperature, the temperature is measured, and the readings are corrected by means of a table. A chemical analysis is necessary in the first case to determine the nature of the impurities in the water, as this apparatus does not discriminate between the different dissolved substances. It indicates and measures as a percentage any change in hardness, however, showing that alternations are required in the softening process. The actual degree of hardness in grains per gallon may be deduced at any time from a curve which is plotted at the time the chemical analysis is made. One important application of the apparatus is for the testing of surface condensers. As any leakage of the cooling water (which generally contains dissolved matter) into the condenser increases the conductivity of the hot well water, a test of the latter will indicate the slightest leak. Taking the conductivity of distilled water at 2, the addition of 1 per cent of London tap water will raise it to 7 while 1 per cent of sea water will raise it to 620. Boiler priming is detected in a similar manner. —Lond. *Elec. Eng'ing*, Nov. 17.

Meter.—The official communication of the Reichsanstalt by which a direct-current motor meter of the Felten-Guilleaume-Lahmeyer Company is admitted for calibration. Two different types are described, one with a single armature and the other with an astatic double armature. Both types can be used for two-wire and three-wire networks. The construction and method of calibration are described.—*Elek. Zeit.*, Nov. 17.

Alternating-Current Potentiometer.—H. TINSLEY.—A complicated vector diagram is given showing the accuracy with which the phase differences and magnitudes of alternating currents in complex circuits can be measured by C. V. Drysdale's alternating-current potentiometer, the angles being read on a dial.—Lond. *Electrician*, Nov. 18.

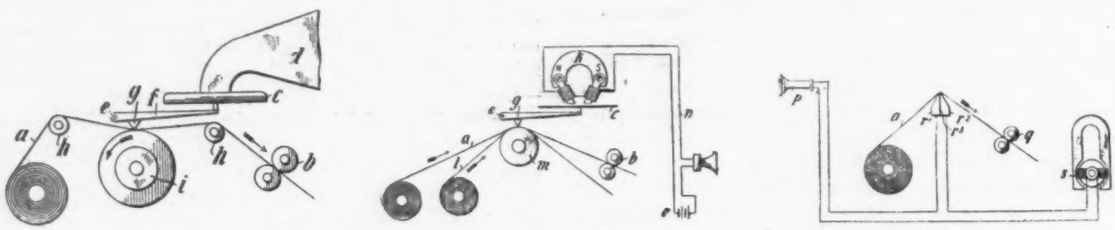
Localizing Faults.—H. E. CANN.—An article on the localization of partial faults in submarine cables by means of Cann's triple test to true zero. A numerical example from practice is added.—Lond. *Elec. Review*, Nov. 18.

Telegraphy, Telephony and Signals.

Long-Distance Telephony.—At the recent Paris conference of telegraph and telephone engineers Breisig discussed some theoretical questions regarding cables loaded with inductance coils according to the Pupin system. Reflection and distortion are important points theoretically. To study fully the former it is necessary to examine the variable condition of telephonic currents—a very difficult task, which had not yet been done. Distortion is produced by the inequality in the attenuation of currents of varying frequency which modifies the tone (timbre). Experiment indicates, however, that distortion is not so important as has hitherto been thought. If this is so, it should be possible to construct telephonic lines more cheaply, especially as regarded the Pupin coils, which cost more because in the past the endeavor has been to give them a resistance more independent of the frequency. Holmstrom stated that the microphone of Egner and himself for long distances, in which a tightly stretched diaphragm is used, does not accord with Bela Gati's theory that it is the highest fundamental sound of the diaphragm which gives the loudest reproduction to the highest frequencies of the human voice. Their diaphragm has

a note of 200 vibrations per second. It is stretched for quite other reasons. By stretching it and fixing the electrode firmly to its center they cause each point of the surface of the electrode in contact with the carbon granule to vibrate exactly with the same phase and the same amplitude. For comparative tests they have used an artificial cable of the British Post Office with a coefficient of attenuation of a little less than 1 per ten miles and an undulation of 5000. With such a cable they had been able to speak over a distance of 130 miles. Breisig said that when the islands in the North Sea were telephonically connected with Germany transmission was very weak because of reflection in the apparatus. Six years ago the secondary of the induction coil and the winding of the receivers were altered so that the whole gave only 20 ohms and the self-induction was increased from 1 to 4 or 5. Speaking then became loud and clear. It was worth while, therefore, to consider the adaptation of the apparatus to the line.—Lond. *Electrician,* Nov. 11.

Phonograph.—A description of a new method due to B. Gwozdz for recording and reproducing sound waves. The record is made in the form of a graphite or lead-pencil line of varying thickness (and, therefore, varying electrical resistance) formed under the control of the sound vibrations on a strip of insulating paper. The reproduction of the sound is effected by introducing successive small portions of the pencil line into an electric circuit containing a telephone receiver, the current through which is consequently varied according to the thickness of the line or the loudness of the corresponding tone.



Figs. 3, 4 and 5—Recording and Reproducing Sound Waves.

No practical test results are at present available, but one method of carrying out the suggested plan is indicated in Fig. 3. In place of a simple pencil line the recording line is here made by varying the pressure with which the paper string *a* is pressed against the graphite roller *i* by the point *g*. The paper strip is drawn over the graphite roller by means of the friction roller *b*; *c* is a membrane fitted to the funnel *d*, into which the sounds are made. This membrane moves the lever *f* about the center *e* and so varies the pressure of the point *g* against the paper. In place of the graphite roller, of course, an actual pencil point might be used or a carbon sheet, such as is employed in the typewriter. The membrane also need not be influenced directly by the sounds. It can be arranged—as in Fig. 4, for instance—to be vibrated by means of an electromagnet *k* actuated by the currents passing into the battery and microphone circuit *n*. In this diagram the graphite roller is shown replaced by a metal roller and a strip of carbon paper *l*. Fig. 5 shows one form of the reproducing apparatus. A circuit is formed leading from some current source *s* to a telephone receiver *p* and to the two metal prisms r_1 r_2, which are separated by the thin insulation strip r_3. The paper strip *a* with the graphite record on it is run, face downward, over the point of the prisms, as shown, thus closing the circuit at each instant by means of a short piece of the record line and allowing a current to pass through the telephone depending on the thickness of the record line at that spot.—*Der Mechaniker,* No. 6; abstracted in Lond. *Elec. Review,* Nov. 11.

Detectors for Wireless Telegraphy.—W. H. Eccles.—A paper read before the London Physical Society on the energy relations of certain detectors used ir wireless telegraphy. The author describes the results of experiments on the properties of electrolytic, carborundum, zincite-chalcopyrite and graphite-galena detectors, small quantities of energy of the same order as in practice being employed. The author shows that the energy in the telephone is linearly connected with that in the detector and suggests that all detectors are fundamentally thermal in action. The latter conclusion differs from that of other experimenters, perhaps owing to the latter employing large quantities of oscillation energy.—Lond. *Electrician,* Nov. 11.

Relay for Wireless Telegraphy.—A note on a recent British patent (10,210, Nov. 3, 1910) of W. P. Thompson (Gesellschaft für Drahtlose Telegraphie, Berlin). In order to be able to receive very weak signals use is made of an oscillating relay in combination with a local telephone circuit. The relay consists of a light oscillating armature supported on two stretched wires and having fixed to it one electrode of a sensitive carbon microphone contact. The armature is tuned to the periodicity of the received signals and resonates to them, the resultant parallel movement giving a good microphone action at the contact. Several such relays may be connected in series with their armatures tuned one to another. Magnetic control of the sensitiveness of the relay is provided. Several combinations in which a transformer and rectifier are used in the circuit of the last relay of a series for the purpose of operating a registering device are described.—Lond. *Elec. Eng'ing,* Nov. 10.

Batteries for Telephone Exchanges.—An article discussing first the local-battery system using primary batteries and the central-battery system using a storage battery. The advantages of the central-battery system are pointed out, and various arrangements of the central-battery system are described with the aid of diagrams, especial attention being paid to the method of charging the battery.—*Elek. Anz.,* Nov. 6 and 17.

Miscellaneous.

Presidential Address.—T. H. Churton.—His presidential address to the Yorkshire Section of the (British) Institution of Electrical Engineers. He believes that the present unsatisfactory state of the electrical industry in England is due to the productive capacity of its factories exceeding the demand of the market that is open to them more than to anything else. He outlines some of the directions in which modern designs of machinery are tending and emphasizes the value of standardization within the factory, although he is not so much in favor of attempts to bring about universal uniformity of details. There is, however, good and sufficient reason for an endeavor to establish agreement as to the definitions of terms used and for the adoption, by general consent, of certain standard specifications respecting the performance of electrical machinery, qualities of materials and other such matters. He does not consider the attempts of the Engineering Standards Committee in this direction altogether satisfactory. He does not agree with the six-hour run as a test for continuous rating nor the one-hour run for intermittent rating on account of the very different time-constants of different-sized motors. Nor are the standard speeds suggested for each horse-power of much use. The standardization of voltages and frequencies is, however, of great importance.—Lond. *Electrician,* Nov. 18; abstracted in Lond. *Elec. Eng'ing,* Nov. 17.

Brussels Exhibition.—G. Schlee.—The first parts of an illustrated article on exhibits of the German electrical industries at the world's fair in Brussels. In the first instalment lighting

equipment, generators, motors and electric hoisting plants are discussed, and in the second instalment measuring instruments and meters are dealt with.—*Elek. Anz.*, Nov. 13 and 17.

Ferranti.—A biographical sketch with portrait of Sebastian Ziani de Ferranti, the new president of the (British) Institution of Electrical Engineers.—Lond. *Elec. Rev.*, Nov. 11.

Technical Education.—C. FARADAY PROCTOR.—His presidential address to the Newcastle Section of the (British) Institution of Electrical Engineers. He said that In England a more practical form of education is required. The present systems tends to regard the successful passing of an examination as a proof of the scholar's knowledge, but it only proves his ability to pass examinations, while the true proof of the efficiency of his education is his ability to earn a good living for himself and a social position somewhat better than that which he would inherit from his parents. He points out how rapidly a good engineering draughtsman or architect can take in the whole of a design and point out errors before the quickest readers could possibly understand a tenth part of it if described in writing, yet how very few people are able to make even a tolerably good sketch. Drawing should be generally learned in schools. The author refers to the "often rather openly shown want of appreciation exhibited by the theoretical student for his practical associates either in the college or works, this resulting in the breach between the practical and theoretical sections of works which so often leads to the want of efficiency, especially in the theoretical departments. It is this breach between the theoretical and practical departments that accounts for the inefficiency of much of our present work." He gives some examples from practical work in a factory. Attention was once called by him to the importance of having the platinum leading-in wires of the lamps thoroughly clean. Several times attention had been drawn to this trouble, but it had not been stopped. "The highly trained scientist is apt to consider such matters as dirt on a piece of wire as something that the foreman should see to, and frequently he is satisfied that his work is done as soon as he has censured the foreman. It is, however, this sort of thing that causes the damage, for by a more judicious process it was found that it was possible to get the wires actually sealed into the glass perfectly clean and yet when the lamp was finished the wires in some cases were dirty or at least black. By following the matter up it was discovered that the glass was being decomposed and the oxide of lead in it being converted into metallic lead on one pole." The matter was still further pushed and indications were obtained of gas given off at the opposite pole. "Education must consist of two primary processes, namely, impressing on the brain a picture, and, secondly, the cultivation of the brain in such a way as to enable it readily to receive the pictures and to be able to call them to mind at will. Profitable education must consist of the opportunities given to the brain of obtaining records and the choice and permanency of the records obtained." The overcrowding of the brain with records seems to crowd out the faculty of putting together the various ideas, or maybe the impression gets so permanent that the mind can only see the thing exactly as it was. As to the importance of clearly understanding a problem, "America is a most striking example. The success in America is the clear view of what might be called the meeting point of every problem—namely, does it pay?" As to the success of industrial developments, "the secret is simply a good, or real, combination of capital and labor, of theory and practice, backed, of course, by good commercial ability." Mr. Proctor finally referred to the "ridiculous and complicated system of weights and measures used in this country, for which system all are individually responsible to some extent." In this connection he indorsed the very practical suggestion that those desirous of aiding progress should follow the example of the American Electrochemical Society, the Illuminating Engineering Society and the American Institute of Electrical Engineers in insisting that all papers containing English measures must have the corresponding metric values to a like degree of numerical precision inserted immediately thereafter.—Lond. *Electrician*, Nov. 4.

BOOK REVIEWS.

EINFÜHRUNG IN DIE TECHNISCHE ELEKTROCHEMIE: ERSTER BAND ELEKTROTHERMIE. Dr. Paul Askenasy. Braunschweig: Friedrich Vieweg & Son. 251 pages, 69 illus. Price, 10 marks.

This is a practical treatise on applied electrochemistry written for chemical engineers and electrochemists. The principal subjects treated are: (1) The electric furnace in relation to calcium carbide and ferrosilicon. (2) The refinement of iron and steel in electrical furnaces. (3) Carbide of silicon. (4) Zinc refining. (5) Nitric acid. (6) Ozone. The text is illustrated by pictures and diagrams of furnaces and other electric installations. Accounts are given of the results obtained in these various installations. There is no algebraic and very little chemical symbolism in the book. The descriptions are clear and simple. Some historical outline of the processes is given. The book will be of interest to students of electrochemical engineering, especially to those inquiring into German practice.

LA PRACTICA DELLA COSTRUZIONI ELETTROMECCANICHE. Second edition. By G. Pardini. Milan: E. Bignami & Company. 500 pages, 346 illus., 12 folding plates. Price, 4 lire.

The standard types of construction used in generators, motors, converters and transformers built on the Continent of Europe are described in detail in this volume. The subject is treated in accordance with the following outline: General discussion of electric machines and their classification; materials used in construction and their properties; effect of losses on the construction; practical limiting factors of design; the magnetic circuit; windings and insulation; mechanical parts (frame, bearings, etc.); accessories (commutators, collector rings, brushes, etc.); testing of materials used in construction; testing of machines; calculation of the mechanical parts; calculation of the electrical constants. The book is profusely illustrated and at the back twelve folding plates of designs are inserted. It is bound in paper covers and is printed on a cheap paper, which partly accounts for the low price of the book.

ARBEITEN AUS DEM ELEKTROTECHNISCHEN INSTITUT DER GROSSHERZOGLICHEN TECHNISCHEN HOCHSCHULE FRIDERICIANA ZU KARLSRUHE. 1908-1909. Edited by E. Arnold. Berlin: Julius Springer. 310 pages, illus. Price, 10 marks.

This is a collection of six experimental researches undertaken during the year 1908-09 at the Karlsruhe Electrotechnical Institute. The reports refer to the following subjects:

Commutation in Direct-Current Machines; The Friction of Dynamo Brushes; The Single-Phase Compensated Repulsion Motor; Alternating-Current Series Motor with Compensating Poles; Interpole Magnetic Leakage; Commutation Phenomena; Contact Resistance Between Commutator and Brushes as Affected by Temperature.

The work has been carefully edited by Dr. Arnold, the well-known designer and electrical machinery specialist, and the book will be of great interest and utility to designers of direct-current and alternating-current machines.

L'ÉLECTRICITÉ CONSIDÉRÉE COMME FORME DE L'ÉNERGIE. By E. Aries. Paris: Hermann & Sons. 176 pages. Price, 5 francs.

A theoretical dissertation upon electrostatic and magnetostatic energy following the analogies presented by thermodynamics. The laws of Kelvin, Ohm, Joule, Coulomb, Gauss, Faraday and other writers are reviewed and collated mathematically. The author deals with the fundamental laws of the distribution of electric and magnetic energy in the space surrounding an electrified or magnetized body. The book will be of interest to advanced students in physics, but is not adapted to the needs of the engineer.

EDISON: HIS LIFE AND INVENTIONS. By Frank L. Dyer and Thomas Commerford Martin. New York: Harper & Bros. 2 vols., illus, 989 pages. Price, $4.

There is altogether too little of electrical biography, and a year in which we receive excellent and adequate studies of two such men as Kelvin and Edison is to be marked with pleasure. In the case of Kelvin there was the opportunity to present a rounded and finished career; and the treatment of his great subject by Prof. S. P. Thompson was perfect. In the present instance it is not possible to tell the full story, for, altogether aside from certain unavoidable limitations always to be encountered when the subject of a biography is alive, Edison happens to be, at the age of sixty-three, in the full tide of activity and productiveness. A man who is improving all his earlier apparatus in light and power, trying to operate steam railroad cars by storage batteries, and building cement villages has not altogether brought his life to a close.

Yet the method adopted in this book is satisfactory, for outside of the personal matter dealing with Edison's boyhood, his successive laboratories, his adventurous youth and toilsome middle age, and his home life, the story is made a record of electrical development during the past fifty years. In other words, with Edison's own work in a given field as the core each chapter is a vivid and complete discussion of the art upon which Edison directed his tremendous energies and in which he made his splendid achievements. Hence, while the book is replete with anecdote, and has no dull pages, it is a serious effort to present our times from an electrical standpoint and to acquaint the public with what has actually been done up to the moment in developing practically all the great electrical inventions. And while the effort has been successful, and while the narrative as a whole has sustained interest and fascination, the technical description of specific inventions has been carried further in a series of appendices based on Edison's patents in each field or group of inventions. In this way the progress of the story is relieved, while the more studious reader can look deeper into the theory and principles involved.

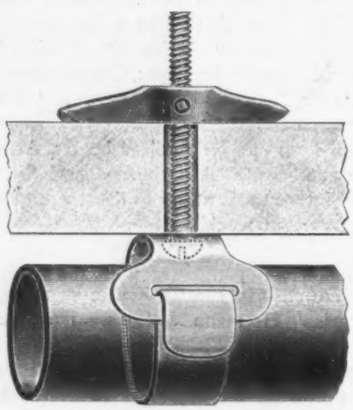
The life of Edison is a rare opportunity for any biographer. The authors of this book have been equal to it and have made a most notable contribution to electrical literature, well written, eminently readable, authentic in its details and authoritative in its data. It not only has Edison's express approval, but embraces a large amount of autobiographic material of an intensely valuable nature from the light it throws on himself. Edison has been called our greatest living American. There is nothing in this book to lessen such an attribution, but much to strengthen the belief that in him we have a unique figure in an extraordinary period of invention and industrial expansion. In the story of his really heroic struggles to conquer nature and learn her secrets there are stimulus and encouragement for all who desire to serve their day and generation.

Owing to the limitations pointed out above this cannot be considered the definitive life of Edison, though a critical biography, when written, will almost necessarily fall far short of the present work in human interest. The future biographer will have a worthy task in analyzing the intellectual processes by which Edison has produced so much for the world; for aside from his utilitarian accomplishments Edison is also a man of powerful intellect and wide range of thought, which facts have been obscured by his wizard-like achievements and the fascination of his very human personality. We hope that in a future edition the technical descriptions in the text will be revised in order to correspond more nearly to the limitations of the average reader. While these passages will satisfy the technician accustomed to the exactitude of the patent specification, they are seldom of the kind that enables one to picture readily in the mind the object described. Another improvement would be in the substitution of good engravings for the abominable half-tones that disfigure the present edition. The work is, however, vastly superior to any of the preceding books on Edison, and should be on the bookshelf of every electrical man, not only on account of its direct subject, but also because its pages incidentally include an admirable epitome of the electrical art during its greatest period.

New Apparatus and Appliances

CONDUIT HANGER.

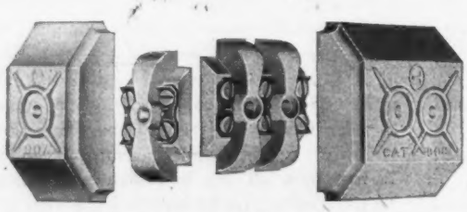
The clamp illustrated herewith has been designed especially for use in suspending electric lighting conduit from hollow-tile ceilings. Use is made of only one toggle per fastening and only one hole is drilled therefor. It is claimed that the construction is more substantial than one involving the use of two toggle bolts, because the latter construction necessitates the drilling of two holes so close together as to weaken the tiling. The hangers are made of zinc and are entirely rust-proof. They are well adapted for use in fireproof buildings. They are made by the Yonkers Specialty Company, Yonkers, N. Y.



Conduit Hanger.

WIRE-SPLICING BLOCKS.

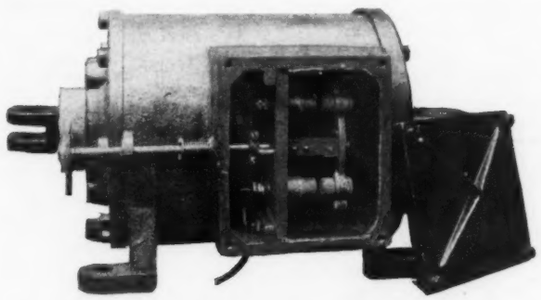
The two-wire and three-wire blocks shown herewith have been designed for "straight-away work" where splicing was formerly necessary. These blocks are arranged to meet the requirements of the Underwriters, according to which joints and taps are not allowed in molding unless protected by fittings. The blocks have been developed for the market by the Trumbull Electric Manufacturing Company, Plainfield, Conn.



Two-Wire and Three-Wire Splicing Blocks.

A LARGE SOLENOID-OPERATED BRIDGE LOCK.

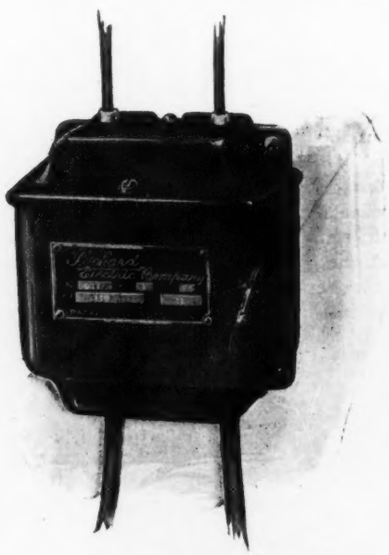
The Havana (Cuba) Electric Railway Company has had built by the Cutler-Hammer Company, Milwaukee, several very large solenoid-operated bridge latches to be used on one of its new interlocking bridges at Havana. The solenoid is designed for operation at street-railway trolley voltage and takes initially about 10 amp, exerting on its 4.5-in. core a pull of 350 lb. through a distance of 4 in. When the core reaches the end of its travel a switch is operated which automatically inserts the protective resistance. This is wound on the electromagnet coil itself, and though reducing the current, acts to increase the effective ampere-turns about the core, providing a powerful holding action on the bolt. The solenoid winding is entirely inclosed against the entrance of moisture and the lock can be mounted on the bridge without respect to external conditions.



Solenoid-Operated Bridge Lock.

PACKARD LOW-VOLTAGE TRANSFORMERS.

Ever since the tungsten lamp was placed on the market there has been a demand for low-voltage transformers to supply current at from 10 volts to 30 volts. While these have been built in a variety of forms a transformer for this purpose deserves better care in its design and manufacture than it has usually received. Its efficiency should be high, since it is to supply high-efficiency lamps. Its insulation should be thorough, though it is built for low voltages, for it will very likely be mounted indoors when there is a fire risk. For the same reason it should be mounted in a substantial case of good appearance. Realizing all of the above points, the Packard Electric Company, Warren, Ohio, has lately improved and amplified its line of "Mazda" transformers, and while the type it has been selling for two years has given good satisfaction, the manufacturer believes that the present type is the superior of anything before attempted. The case is cast iron of exceptionally neat design. The insulation and general construction are the same as for higher voltages, and the efficiencies are said to be high. These transformers are furnished in 1/10 kw, ⅛ kw, ¼ kw, ⅓ kw, ½ kw, 1 kw and 1½ kw sizes for either 110 volts or 220 volts primary and for secondary voltages of 10 to 30, the lower voltage being for sign lighting.



Low-Voltage Transformer.

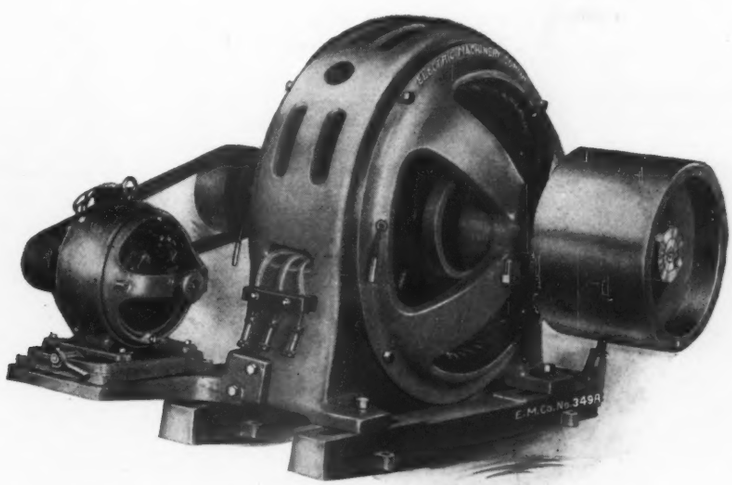
DIRECT-ATTACHED BELTED EXCITERS.

The modern electric light plant in cities of moderate size generally contains belted alternators of capacities of 200 kw or less, which are generally excited by a small direct-current belted exciter installed on a separate foundation driven by a belt from a pulley on the alternator shaft. An objection to this method is that the operator experiences difficulty in maintaining proper belt tension, the adjustment of the main alternator belt disturbing the exciter belts and frequently resulting in a hot box on the exciter.

To overcome this and other objections the Electric Machinery Company, of Minneapolis, Minn., has recently put on the market moderate-sized alternators with direct-attached belted exciters, as shown in the accompanying illustration. This type of alternator with exciter mounted on a cast-iron bracket, which is attached directly to the alternator frame so as to move with it, eliminates the difficulty experienced by operators in maintaining proper belt tension on both the main belt and the exciter belt, so as not to endanger the exciter bearing in case the exciter belt is too tight, or, on the other hand, allow the exciter belt to slip off and interrupt service if it is too loose. These alternators are furnished in sizes from 30 kva to 180 kva, 600 r.p.m. to 1200 r.p.m.

The belt centers are shorter than in the case of separately mounted exciters, but the two pulleys are made amply large and of generous width of face. The exciter and the alternator are of the standard spherical design. Each alternator rail has its own ratchet head and the two ratchets are locked together by a cross bar so as to be operated simultaneously by a single lever. The machine may be pushed or pulled by these ratchets by simply throwing the little pawls to the right or to the left.

It is stated that the cost of this arrangement is less than that of an exciter on a separate foundation with a long belt, while it will also secure to the exciter a good deal better attention from the operator and also require much less floor space



Alternator with Direct-Attached Belted Exciter.

than the usual way. In case of trouble with the direct-attached belted exciter it can be replaced instantly by any belted exciter while the trouble with the regular exciter is being repaired. In case of trouble with a direct-connected exciter it is much more difficult to install a temporary exciter.

MOTOR-STARTERS, MILL AND CRANE CONTROLLERS.

A line of direct-current and alternating-current motor-starters and mill and crane controllers has recently been placed upon the market by the Allen-Bradley Company, of Milwaukee, Wis. These devices are of the carbon-compression type, the resistance element being in the form of two columns of prepared graphite disks. As is well known, the contact resistance of such columns varies with pressure, and resistance changes

Fig. 1—Direct-Current Motor-Starter.

are caused by subjecting the columns to various degrees of compression. The columns are inclosed within an insulated steel tube which is provided with suitable terminals and a plunger for transmitting the pressure to the disks contained therein. The graphite disks are well adapted for rheostatic service, as they will not crush or break, are not affected by any temperature encountered in rheostatic service, cannot be fused, will not corrode and are not changed materially by years of service.

Whatever switching is necessary in combination with these devices is accomplished by suitable contacts attached to the compression mechanism. A 35-hp Allen-Bradley direct-current motor-starter is shown in the accompanying illustration (Fig. 1). The tube containing the resistor columns is mounted on the front of the slate panel. The operating lever is of the ordinary form and the compression of the resistor column and the consequent cutting out of the resistance are brought about by

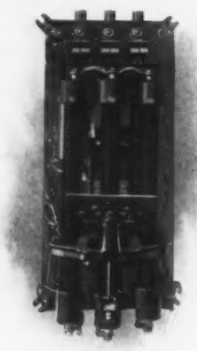


Fig. 2—Starter for Slip-Ring Induction Motors.

raising the lever as is done in the ordinary type of starter. Owing to the gradual change of resistance the starting of the motor is accomplished without jerks or flashing.

The mill and crane controller, shown in Fig. 3, embody the described compression resistor and are built to withstand the most severe controller service. In the alternating-current motor-starters for slip-ring and squirrel-cage induction motors the mechanical pressure exerted upon the resistors in the several phases is equalized by means of suitable mechanism so that the resistance in each of the phases is always the same at any instant and unbalancing is thereby prevented.

The squirrel-cage starter is so designed that when the switch is thrown into the starting position the elongation of the resistance columns, due to heat expansion, is retarded in such a manner as gradually to compress the resistor columns, which results in automatically reducing their resistance until the motor starts. After the motor has reached its normal speed the switch is thrown into the running position, at which point the running fuses are brought into circuit. Fig. 4 shows the

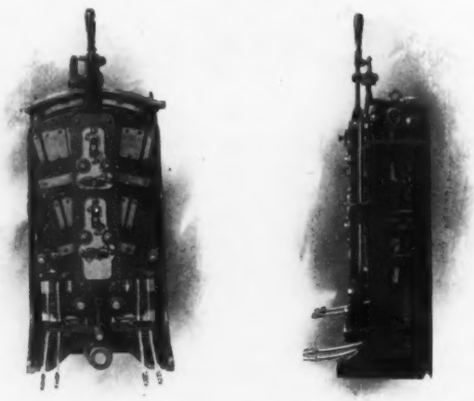


Fig. 3—Mill Controller.

squirrel-cage starter with a conventional switch, but different types of switches can be employed to meet varying conditions. It is claimed that the even and gradual current flow when starting the motor, the increased torque when the motor is accelerating, together with its simplicity and ruggedness, make this type of rheostatic starter in many cases, as when the motors are small or medium-sized, a more serviceable device than the complicated auto-starter.

The manufacturers state that while these rheostatic starters require in their operation about 15 per cent more power from the line than is demanded of the auto-starter, the actual current supply to the motor is no greater and oftentimes less, as the starter automatically prevents more current from flowing than is absolutely necessary to start the load, even though the load may vary at different starting periods. As the wattless component of the line current is less with the rheostatic starter, the disturbance to the line voltage is no greater than with the auto-

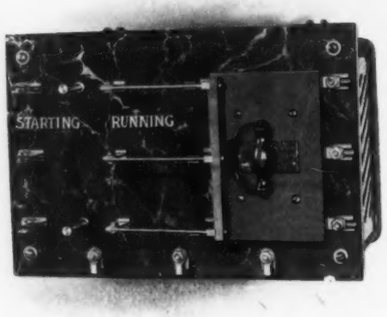


Fig. 4—Starter for Squirrel-Cage Induction Motors.

starter. It will be noted also that the running fuses are protected during the accceleration of the motor, so the greater line current is seldom an objection. This type of starter is made in capacities up to 25 hp.

The slip-ring starter, shown in Fig. 2, is equally simple and durable in its construction. The starting of the motor is done manually by means of the operating lever, there being no automatic action in connection with this device. Among its good features the most notable is that of causing even acceleration of the motor without flashing or destruction. It is made in four sizes, varying from 1 hp to 100 hp.

TELEPHONE SYSTEMS IN MINES.

The past few years have witnessed quite a few installations of telephone systems in underground shafts. When the Legislature of Illinois, following the disaster of last year in the Cherry mine, passed a law requiring the adoption of protective devices in mines one of the results was an increased interest in telephones in all the mining sections of the country. New types of iron-clad telephones have been developed by manufacturers to meet the augmented demand. In the coal fields of Pennsylvania considerable attention is now being paid to underground telephone systems. Mine operators have recently come to realize that the telephone system, reaching every important part of the mine and placing the most remote shaft or gallery in instant touch with every other important point, is an indispensable feature of the mine equipment. An installation in the engine-room of a coal mine near Pittsburgh is the subject of the accompanying illustration, taken from a photograph obtained 12,000 ft. from the entrance to a shaft. The Western

Telephone in a Mine.

Electric instrument has its inner parts protected by two metal doors, only one of which, as can be seen in the picture, is open when the telephone is in use. Electric lamps have been placed near the telephone to keep the air surrounding the instrument as dry as possible. In shaft mines the telephones are sometimes connected with wires maintained primarily for other purposes. Such circuits are not insulated, and miners traveling about in the tunnel are able to bridge across the circuit at any point and to give signals from any part of the mine. A few weeks after a telephone system had been installed in one mine in the Pittsburgh district the telephone was instrumental in checking a serious underground fire. An employee detected the smell of smoke and, running to the nearest telephone, informed the private-branch exchange operator at work in a building near the mouth of the mine. The operator called each telephone in the shaft and men were sent out from all points to search for the blaze. At the same time the superintendent, who was at his home, was notified by telephone. In this way the fire was reached and extinguished through the timely warning given over the telephone.

WIRING ENTRANCE BOXES.

The entrance box illustrated herewith is provided with bushing holes at the top and the bottom large enough to accommo-

Fig. 1—Two-Pole Type of Wiring Box.

date either bushing or ½-in. conduit so that the box is interchangeable for either open-type or conduit wiring. The box

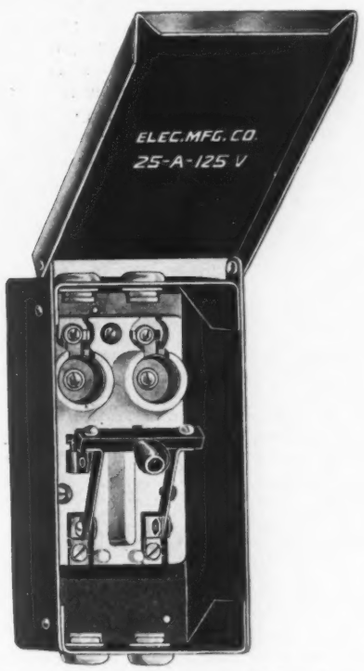


Fig. 2—Two-Pole Type of Wiring Box.

has been placed on the market in both the two-pole and three-pole type by the Electric Manufacturing Company, New Orleans, La.

Industrial and Commercial News

The Week in Trade.

THERE was some revival in business last week, due to the stimulating effect of the holiday trade throughout the country. With few exceptions, the jobbers reported this trade as being very good. Especially excellent reports are received from the South, where the high prices for cotton have had a beneficial effect, and from the Northwest, where the cereal crops were marketed early. Retail trade in the industrial centers is not so active and is hardly satisfactory. The general spread of cold weather has also had the effect of increasing the demand for heavy wearing apparel. In the industrial lines there is little change to be noted, and the iron and steel mills are only operating at about one-half of capacity in most sections. The coal trade shows some activity, but pig iron is still dull and prices are uncertain. The advance of the season has checked building operations, and structural iron and lumber are quieter in consequence. During the past week the Pennsylvania Railroad Company placed its order for 150,000 tons of steel rails. While this tonnage is somewhat larger than was expected, it is less than that placed last year. The allotments of the orders of the company have not yet been accepted by all of the steel companies with which they were placed, and it is intimated that there will be considerable discussion regarding specifications before the order is finally booked. The New York Central Railroad is reported to be figuring on an order of 100,000 tons. These are the only rail orders of any importance in sight. The railroads do not appear to be disposed to order cars or other equipment unless they can get them at lower figures than have as yet been quoted. In fact, throughout the entire industrial and traction world there is a feeling that the country is approaching a period of moderate activity. Collections, which are quoted as from slow to good, are relatively best in the South. Business failures for the week which ended Dec. 1, as reported by *Bradstreet's*, were 217 as against 212 the previous week, 230 in like week of 1909, 234 in 1908, 272 in 1907 and 216 in 1906.

The Copper Market.

ELECTROLYTIC copper declined during the past week about ⅛c. per lb. in the local market and from 10s. to 15s. per ton in Europe. The reaction in the price of standard and other grades of copper was equally pronounced. It is beginning to be generally realized that, in spite of the many optimistic publications that the copper producers and their selling agents are making, the statistical position is not at all favorable. This realization has led to the liquidation of some standard contracts and to the freer offerings of electrolytic for shipment. The demand from consumers, both here and abroad, has been light. Although the activity in the electrical industry has been so pronounced that copper dealers have believed that the stocks in the hands of manufacturers must be running low, no evidence of such depletion has yet been shown in the market. It is not improbable that most of the large users of copper are covered to February or March. The market is now anxiously awaiting the figures of the Copper Producers' Association, which will be made public at the end of the present week. If the production figures at this time show any considerable effect of the promised curtailment, the copper market will immediately feel the result in an improvement of tone and possibly in a strengthening of prices; but if the production figures still show that the output is running at something near the figures that have been given out during the summer and fall it will be taken to mean that the surplus stock has largely increased. This will be understood whether the increase of surplus shows in the actual figures or not. Exports of copper during November were 29,097 tons, according to the Custom House figures. Exports of November a year ago were 24,028 tons, and in November of 1907 were 34,087 tons. This indicates that the shipments of copper are a trifle better than last year, but not so good as in the prosperous days of 1907. The total exports of copper since Jan. 1 up to the end of November have been 268,965 tons, as compared with 273,553 tons in the same period last year, and 268,353 tons in 1908. From this it can be seen that the general consumption of copper abroad has varied very little within the past three years. Imports of copper during the month are estimated to have been between 12,000 and 15,000 tons. Since the first of December exports have been 3,787 tons. The daily call on the Metal Exchange Dec. 5 quoted standard copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.40	12.50	....
December	12.40	12.50	12.45
January	12.45	12.60	12.52
February	12.45	12.60	12.52½

The London market, December 5, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	57 3 9	56 18 9
Standard copper, futures	58 0 0	57 15 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£32 15 0
London, futures	65 18 0	53 7 6
Best selected	65 10 0	57 15 0

Industrial and Commercial Notes.

Oil Engines for Wireless Equipment.—Mietz & Weiss, manufacturers of oil engines, New York, have recently taken an order from the United States government for eight 3-cylinder, 12-hp, self-starting oil engines, to be used on warships for operating the wireless equipment. These engines will be direct-connected with the Siemens-Halske generators. The wireless equipment will be furnished by the Telefunken Wireless Telegraph Company. This is the second order of this kind the same manufacturers have received from the navy. The first order, which was referred to in our issue of July 14, 1910, was for engines of 7-hp. Mietz & Weiss report that the demand for oil engines for service in small central stations and isolated plants is very active. There has also been a large sale of this class of machinery to small water companies and pumping plants for irrigation purposes.

Westinghouse Electric & Manufacturing Company.—The Republic Iron & Steel Company has closed a contract with the Westinghouse Electric & Manufacturing Company for seventy-nine crane and mill motors, aggregating about 5000 hp. These motors will be used in the plant of the steel company at Youngstown, Ohio, and will replace most of the shafting and belts now used by the company. The contract also includes magnetic controllers for the large motors and manually operated controllers for the smaller motors. The Westinghouse company also closed a contract with the American Graphophone Company for 1000 small motors.

Allis-Chalmers Company.—A contract has been placed with the Allis-Chalmers Company by interests identified with the Telluride Power Company of Provo, Utah, for an 8000-hp water turbine generator set with transformers, switchboards, etc., to be utilized at the Grace plant, on the Bear River. Energy from this plant will probably be transmitted to western Idaho and eastern Oregon. The Telluride Power Company has now in operation four hydroelectric plants, the total output of which is about 43,000-hp. It is estimated, however, that there is 60,000-hp still undeveloped at the Bear River site.

Price of Gas in Chicago.—A Seventy Cent Gas League has been formed to aid in securing a reduction in the price of gas in Chicago, as the result of pending negotiations between the City Council and the People's Gas Light & Coke Company, from 85 to 70 cents a thousand feet. By the aid of tungsten lamps many of the residence customers of the Commonwealth Edison Company find electric lighting more cheap than gas lighting. A lnrge number of bills are sent out by the central-station company every month to houses and apartments where the bill is less than a dollar.

Cleveland May Increase Street Railway Fares.—The period for the trial of the 3-cent fare plan by the Cleveland Railways Company terminated Nov. 30, and President John J. Stanley of the railway company has announced that, under the present plan of operation, the 3-cent fare has been found inadequate. Street Railway Commissioner Dahl, representing the city, says that nearly 200 more cars are needed for immediate service. In the event that it is decided that the 3-cent fare has been a failure a 4-cent fare will be given a trial for a reasonable period.

North Shore Electric Company.—During the twelve months which ended Sept. 30 the North Shore Electric Company, of Chicago, showed a very satisfactory increase in both gross and net earnings. The balance available for dividends at the end of the year was equal to 5.36 per cent on the $4,964,000 of stock outstanding. The gross revenue of the company was $1,386,062, an increase of about $380,000 over the previous year. President Samuel Insull says that during the year the company's connected load showed an increase of more than twice as much as in any previous year. This improvement was accomplished, notwithstanding the fact that the full benefits from the new properties acquired during the year were not entirely realized. The connected load, exclusive of railway power business, during the fiscal period was increased to the equivalent of 453,238 16-cp lamps, as compared with 309,786 the previous year. During the year the company extended its high-tension transmission lines into new territory and built additional substations for use in connection therewith, permitting an extension of the system to the lake district of northeastern Illinois. The entire territory now served approximates 1284 square miles. At the annual meeting of the stockholders, Nov. 28, the old board of directors was re-elected as follows: Samuel Insull, Edward P. Russell, Charles H. Randle, William A. Fox, Solomon A. Smith, Louis A. Ferguson and Frank J. Baker. Officers were re-elected as follows: President, Samuel Insull; vice-president, Frank J. Baker; secretary and treasurer, John H. Gulick; assistant secretary and assistant treasurer, E. D. Alexander.

Norsk Electric & Brown Boveri Company.—The new plant at Sköier of the Norsk Electric & Brown Boveri Company is now the largest electrical works in Norway. This concern was founded in 1908 and is a consolidation of the Norsk Electric Aktiebolag (Norwegian Electrical Company) founded in 1873 and the Norwegian branch of Brown Boveri Cie, established in 1901. The old plant of the former company at Sköier has been largely extended, and while the old Brown Boveri plant at Sagene is retained it will be used exclusively for the manufacture of motors of from ½ hp to 100 hp. The main factory at Sköier has two departments, the electrical and the mechanical. The electrical department makes all kinds of electrical machinery, transformers, apparatus, instruments, etc. At present the company has on hand contracts for six transformers of 3000 hp and 50,000 volts, two 3000-hp generators, one 1400-hp generator and one 1200-hp rotary converter. The mechanical department manufactures transmission line equipments, cranes, transportation equipments, etc. Among other large contracts this department has one for the complete installation at the combined unloading and transportation system for Christiania harbor, one 25-ton traveling crane and one 15-ton jib crane. The company has facilities for molding single pieces as large as fifteen tons. The company employs 500 men. The capital is 1,400,000 kroner ($380,000). The general manager is M. Feddersen.

Byllesby Annual Convention.—The second annual convention of the managers and department heads of H. M. Byllesby & Company and affiliated companies will be held at the Congress Hotel, Chicago, Jan. 17-20. As is well known, the company, which has headquarters in Chicago, operates and manages a considerable number of electric, gas and street railway properties in the West and South. Since the first convention held last year several properties have been added to the list and the former attendance of 200 will probably be largely increased. At a recent meeting of a committee of managers preliminary arrangements were made for a four days' program to be devoted to technical and professional subjects. It is the belief of President Byllesby that the annual meetings and interchange of ideas among managers and department heads accomplish much toward improving the service offered the public in the various cities where utilities are operated by this organization.

Joint Traction Rate Ordered.—The Public Service Commission of the First District of New York has denied an extension of time to the receivers of the Metropolitan Street Railway Company in which to put into effect the joint rate between the Metropolitan Company and the Central Park, North & East River Railway Company. The order for this joint rate was made by the commission Aug. 2, 1910. The time in which the companies were ordered to put in effect the joint arrangement expired Dec. 5. Under the new order passengers transferring from one of these lines to the other will be given a transfer slip for an extra three-cent fare. Since receivers were appointed there has been no transfer arrangement, two fares being charged.

New Long Island Traction.—The Public Service Commission of the First District of New York has ordered a hearing on Dec. 15 on the application of the Brooklyn & Jamaica Bay Railway Company for a certificate of public convenience and necessity for the construction of a street railroad from Montauk and Liberty Avenues, Brooklyn, to the shore of Jamaica Bay, near the mouth of Mill Creek. It is proposed to construct a single-track trolley line. The Brooklyn & Jamaica Railway Company was incorporated in June, 1910. Horace J. Subers is president of the company.

Union Switch & Signal Company.—The Illinois Traction System has awarded a contract for the installation of automatic block signals on 100 miles of its line to the Union Switch & Signal Company, of Pittsburgh. The fact that the traction company intended to install such signals was published in our issue of Nov. 17. This contract is said to be the beginning of the installation of automatic signals on the entire 550 miles of track of the system.

United Wireless Telegraph Company.—A contract has been closed by the United Wireless Telegraph Company of New York with the Merchants & Miners' Transportation Company of Baltimore for the installation of wireless apparatus aboard twenty-three of the company's steamships. When these installations are completed the entire fleet of the Merchants & Miners' Company will be equipped with wireless service, two of the ships having been previously furnished with outfits. The ships of this company ply between Baltimore and Philadelphia and the Atlantic seaports.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Portland, Ark.; Point Richmond, Cal.; Pueblo, Col.; American Falls, Idaho; Sioux City, Ia.; South Framingham, Mass.; Big Rapids, Mich.; Akron, Ohio; Schuylkill Haven, Pa.; Carbonate, S. D.; Waco, Tex.; Brigham City, Utah; South Boston, Va.; Whitewater, Wis.; Calgary, Alta., Can.; Port Arthur, Ont., Can., and Sherbrooke, Que., Can.

No McCall Power for Baltimore Railways.—It is reported that the directors of the United Railways & Electric Company of Baltimore have decided, upon the recommendation of Engineer Stillwell, not to make a contract with the Pennsylvania Water & Power Company for 17,000 kw of current to be generated at the McCall's Ferry dam. It had been previously announced that the contract was completed.

Electrical Credit Association of Chicago.—The fifteenth annual meeting and dinner of the Electrical Credit Association of Chicago was held at the University Club, Dec. 7. Officers were elected for the ensuing year.

Financial.

THE WEEK IN WALL STREET.

WALL STREET presented an uncertain and irregular market during the past week, with the distinct tendency toward lower prices. While in many quarters this particular movement is attributed to the pessimistic expressions of James J. Hill, it is generally recognized that his plain-spoken prediction of slack business during the ensuing year was only the final push which started the downward movement that was already overdue. For several months industrial and commercial conditions have not been satisfactory, and this fact was thoroughly understood. It merely needed some prominent authority to call public attention in an emphatic manner to this situation to cause a selling movement. For some time past the stock market has been artificially upheld, and this was no secret to the majority of Wall Street traders. It is now the opinion of many of the wisest men in the financial district that this movement toward lower prices will be of distinct benefit to the market. It will remove the labor and danger of artificially maintaining prices at a higher level than conditions warrant. One of the results of last week's decline is the re-awakening of the bear element in stocks, which has been afraid as long as manipulators were in charge of the market to undertake any dealing. These bearish influences are not strong enough to create any

serious demoralization, but unless the powerful money interests again take hold of the market the bears will succeed in holding prices on a level nearer to the present commercial status of business. Following Mr. Hill's expression came the statement from Judge Gary, of the steel trust, in which he plainly said that the bookings being taken at the present time by the big corporations were only averaging 50 per cent of capacity. Deliveries are probably 15 per cent higher, but these represent bookings taken in the summer and early fall. The present low rate of orders indicates that deliveries will not be very heavy during the early spring. Judge Gary's statement, however, gave the distinct understanding that steel manufacturers, independent as well as the trust, were acting in harmony, and indicated very clearly that there were not likely to be any serious reductions in price or competitive wars. It is clearly shown by this statement that the great railroads of the country, which as a rule purchase one-third of the tonnage of the steel mills, are not taking one-tenth of their usual amounts. Developments in the money market during the week all favor a better bond market after the first of the year. Rates continue to be very easy, and supplies in the banks were heavy. Quotations Dec. 5 were: Call 2½ @ 2¾ per cent; 90 days, 4 @ 4½ per cent. The quotations in the table are those of the close Dec. 5.

NEW YORK.

	Nov. 28.	Dec. 5.	Shares Sold.		Nov. 28.	Dec. 5.	Shares Sold.
All. Ch.	9⅞*	8⅛*	300	Int.-Met., pf..	52¾	53⅛	15,800
All. Ch., pfd	33	30⅛*	1,000	Mackay Cos..	92⅝*	90*	400
Amal. Cop...	67	64⅜	139,970	Mackay C.,pf.	75*	74⅞	225
Am. D. T....	20½*	20½*	———	Man. Elev....140		140	450
Am. Loco....	37¾	36½	5,200	Met. St. Ry..	15*	15*	———
Am. Loco., pf.106	¾*	105⅛	325	N.Y.&N.J.Tel.139	¼	139¼*	———
Am. Tel. & C.	84*	80*	23	Steel, com...	76⅝	73¾	1,188,720
Am. T. & T..140	¾	139½*	16,041	Steel, pfd....117	¼	115¾	10,650
B. R. T.....	75⅝	74⅞	22,930	W. U. T....	71	70¼	2,900
Gen. Elec....157	½	151	9,200	West'h, com.	68¼	67	6,300
Int.-Met. ...	19⅛	19⅝	19,675	West'h, pfd..123*		122½*	100

PHILADELPHIA.

	Nov. 28.	Dec.5.		Nov. 28.	Dec.5.
Am. Rys.....	43*	42¾	Phila. Elec.....	15½	15⅝
Elec. Co. of A.....	11¾*	11¾	Phila. R. T.....	18⅛	18¼
Elec. St. B'ty.....	48	47	Phila. Trac.....	83	83*
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	43⅛	43¼*

CHICAGO.

	Nov. 28.	Dec.5.		Nov. 28.	Dec.5.
Chi. City Ry.....170*		170*	Chi. Tel. Co.....123		123
Chi. Rs., Ser. 1....	91	92*	Met. El. Co.....	20	20
Chi. Rs., Ser. 2.....	25¼	23⅛	Met. El., pfd.....	65	65
Com. Edison.....116		115	Nat'l Car.....123		123*
Chi. Subways.....	4½	4¼*	Nat'l Car, pfd.....119*		119*

BOSTON.

	Nov. 28.	Dec.5.		Nov. 28.	Dec.5.
Am. T. & T.....140½		140	Mex. Tel.....	5*	5
Cum. Tel.....145*		145*	Mex. Tel., pfd.....	6	6¼*
Edison E., Ill.....281		280*	N. E. Tel.....138*		138
Gen. Elec.....157¾		152	W. T. & T.....	19	16½
Mass. E. Ry.....	19¼	18*	W. T. & T., pfd.....	91	90
Mass. E. Ry., pfd...	86	85*			

*Last price quoted.
Shares sold for week Nov. 28 to Dec. 5.

Financial Notes.

Westinghouse Machine Company Financing.—The creditors' committee of the Westinghouse Machine Company has mailed a letter to the holders of the $6,473 000 outstanding three-year collateral notes. The circular proposes a plan for refunding these notes. In addition to these notes, which are due Jan. 2, 1911, the company has outstanding $140,000 first mortgage bonds, $800,000 of bonds out of an authorized issue of $1,000,000 and $825,000 of prior debenture bonds, making a total of $8,238.-000. It is proposed that the company issue a $10,000,000 three-year first mortgage and refunding issue of notes bearing 6 per cent, of which $1,765,000 will retire the bonds above mentioned, and then the $6,473,000 of notes will be extended for three years, with the new bonds given as security at a collateral value of 90 per cent. The right is given to the holders to exchange the notes for new bonds on the basis of 97½ per cent. It is said that note holders representing $3 000,000 have already agreed to the extension, provided the unanimous consent of the remaining holders is obtained. It is also stated that New York, Philadelphia, Boston & Pittsburgh bankers who are interested in the notes have agreed to the plans. Further provision for the extension will be the creation of a voting trust, which will control the election of directors during the life of these notes. The committee will also require the payment of a minimum amount of $150,000 into the sinking fund, and in addition thereto 25 per cent of the earnings of the corporation, after expenses and fixed charges have been deducted, for the further security and retirement of the bonds from time to time.

Western Telephone Merger.—It has been reported in Columbus, Ohio, that the Bell telephone interests in that State, the so-called Morgan interests and the remaining independent telephone concerns in Ohio, Indiana, Michigan and western New York are negotiating plans for the formation of a consolidated company with $50,000,000 capital. A conference was held in Columbus two weeks ago and financiers representing all of these important interests have recently been conferring in New York City. No official information will be given out by any of the interests mentioned. It is said that a public utilities bill is being prepared which will enable the telephone companes in the State of Ohio to merge, and will give the State Railroad Commission power to regulate the business. This bill, it is said, will practically embody all of the provisions now demanded by the Oho people, the telephone interests conceding this much in order to get a provision in the law that will enable them to eliminate competition. The argument to be made to the Legislature is that under the federal law at the present time telephones are controlled by the Interstate Commerce Commission and are practically on the same basis as railroads.

Commonwealth Edison Company.—The annual meeting of the stockholders of the Commonwealth Edison Company was held in the Edison Building, 139 Adams Street, Chicago, on Nov. 28. The old board of directors was re-elected as follows: Henry A. Blair, Edward L. Brewster, Benjamin Carpenter, Samuel Insull, Joseph Leiter, Robert T. Lincoln, John J. Mitchell, Byron L. Smith and A. A. Sprague. The executive committee consists of Messrs. Brewster, Sprague, Lincoln, Mitchell and Insull. The following officers of the company were re-elected: President, Samuel Insull; first vice-president. Robert T. Lincoln; second vice-president, Louis A. Ferguson; secretary and treasurer, William A. Fox; assistant secretary. Robert L. Elliott; auditor, John H. Gulick; assistant to the president, John F. Gilchrist.

Kings County Electric Light Bonds.—At the auction of securities in New York last week $50,000 of the 5 per cent bonds of the Kings County Electric Light & Power Company were sold at prices ranging from 100⅜ to 100⅞. Two similar lots of these bonds were sold the previous week, the top price at that time being 101¼. There has been an excellent demand for these bonds for some months owing to the increased earnings shown in the company's monthly reports. The company issued last March $2,500,000 6 per cent debentures convertible into stock at par and has now pending before the Public Service Commission an application to issue $2,500,000 more of the same kind. The first issue of these debentures was fully subscribed by the stockholders.

Detroit United Railway Company.—It is estimated that the gross earnings of the Detroit United Railway Company for the calendar year will amount to more than $9.400,000, which will be an increase of more than $1,300,000 over the previous year. The monthly reports of earnings show that the surplus at the end of the year will be in the neighborhood of 12 per cent on the outstanding capital stock. It is not believed, however, that the company will resume dividends in the near future. The failure of the stockholders to respond to the offer of bonds which was recently announced will act as a deterrent in the matter of dividends.

Michigan Interurban Light & Power Company.—The property and franchise rights of the Interurban Light & Power Company, of Mason County, Mich., have been purchased by a syndicate headed by F. R. McMullen, of Chicago. It is proposed by the new owners to develop the extensive hydroelectric properties of the company by the construction of three dams and to supply energy for lamps and power in the region adjacent to Hamlin Lake. It is also proposed to construct an electric railway from Muskegon to Manisteo.

Public Service Corporation of New Jersey.—At a meeting of the directors of the Public Service Corporation of New Jersey last week Horatio G. Lloyd and J. Horace Harding were elected members of the board of directors to fill vacancies. Mr. Lloyd is a member of the firm of Drexel & Company, of Philadelphia, and Mr. Harding of the firm of Charles D. Barney & Company, of New York. Edgar B. Ward had previously been chosen as a director to succeed the late Dr. Leslie D. Ward.

Edison General Electric Company.—The Edison General Electric Company of Schenectady certified to the Secretary of State of New York last week that it had been dissolved with the consent of the stockholders. This company was a subsidiary of the General Electric and the fact that the stockholders had voted to dissolve was published in our issue of July 21, 1910. The General Electric Company held 149,920 shares out of a total of 150,000.

Western States Gas & Electric Company.—H. M. Byllesby & Company, of Chicago, have filed articles of incorporation at San Francisco for the Western States Gas & Electric Company. The new corporation will have a capital of $15,000,000, of which $10,000,000 is preferred. The company will immediately take over the Stockton (Cal.) Gas & Electric Company and the Richmond Light & Power Corporation in Contra Costa County, California. Other properties, it is understood, will also be taken over, although no definite announcement in regard to any others has been made. It is reported that negotiations are pending for control of the American River Electric Company, which transmits energy to Stockton, and the Humboldt Electric Light & Power Company, which has a sixty-five-mile transmission line from Trinity County, Cal., to Eureka.

Chicago Traction Sale.— The bondholders' reorganization committee of the Consolidated Traction Company, of Chicago, through Andrew Cooke, bought in the entire property at the foreclosure sale last week for $1,425,000. The Electric Railways interests now practically control the entire situation, and it is said that the consolidation plans will proceed smoothly. The second injunction suit by the Yerkes estate against the disposition of the securities held by that estate, it is claimed, will not in any way delay the reorganization plans. The committee claims that these securities have already been transferred. The Chicago Consolidated Traction Company reports a deficit for August of $4,038 and for the three months which ended Aug. 31 a deficit of $606,691.

Westchester, Kenneth & Wilmington Railway Defaults.—The Westchester, Kenneth & Wilmington Electric Railway Company, of Kenneth Square, Pa., having failed to pay the Dec. 1 interest on its $420,000 issue of 5 per cent bonds, two bondholders' committees have been formed in Philadelphia. One of these committees wants the bonds deposited with the Integrity Trust Company, of Philadelphia, under a plan which contemplates the cancellation of the defaulted coupons as well as those which will be due next June, and the reduction of the interest rate to 4 per cent. The other committee is headed by George B. Atli, of Philadelphia, who seeks to put the property "in the hands of experienced street railroad men." The company passed through a receiver's hands in 1905.

Long Acre Electric Light & Power Company.—The Public Service Commission of the First District of New York has called a hearing for Dec. 7 on the application of the Long Acre Electric Light & Power Company for authority to issue $10,000,000 of preferred stock and $50,000,000 of bonds to be secured by a mortgage on its property. This hearing was held in pursuance of the mandamus of the appellate division of the Supreme Court, which on certiorari proceedings annulled the former determination of the commission in denying this application and referred the matter back to the commission for further consideration.

Boston Elevated Railway Company.—The Railroad Commission of Massachusetts has granted the petition of the Boston Elevated Railway Company for authority to sell at auction 1,049 shares of an unsubscribed issue of 27,800 shares of the West End Street Railway Company of Boston. The gross receipts of the Boston Elevated for November show an increase of only about $10,100, which is the smallest gain for any month, with the exception of June, in the present calendar year.

DIVIDENDS.

Buffalo General Electric Company, quarterly, 1½ per cent, payable Dec. 15.

Continental Passenger Railway Company, semi-annual, 6 per cent, payable Dec. 30.

Duluth-Superior Traction Company, preferred, quarterly, 1 per cent; common, quarterly, 1¼ per cent, payable Jan. 3.

Indianapolis Street Railway Company, semi-annual, 3 per cent, payable Jan. 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable Jan. 3.

Massachusetts Electric Companies, preferred, semi-annual, 2 per cent, payable Jan. 2.

Muskogee Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable Dec. 15.

Oklahoma Gas & Electric Company, quarterly, 2 per cent, payable Dec. 15.

Providence Telephone Company, quarterly, 1 per cent, payable Jan. 2.

San Diego Consolidated Gas & Electric Company, quarterly, 1¾ per cent, payable Dec. 15.

South Jersey Gas & Electric Traction Company, semi-annual, 4 per cent, payable Jan. 1.

South Side Elevated Railroad Company, quarterly, ½ per cent, payable Dec. 30.

Standard Gas & Electric Company, Chicago, preferred, quarterly, 1¾ per cent, payable Dec. 15.

Twin City Rapid Transit Company, quarterly, preferred, 1¾ per cent; common, 1½ per cent, both payable Dec. 16.

REPORTS OF EARNINGS

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
October, 1910	$9,598	$5,828	$3,370	$1,944	$1,826
October, 1909	8,937	5,612	3,325	1,951	1,374
Blackstone Valley Gas & Electric Company:					
October, 1910	92,366	48,488	44,878	30,238	14,640
October, 1909	93,867	47,919	45,948	29,421	16,527
Buffalo General Electric Company:					
10 months ended Oct. 31, 1910	867,525	531,095	336,431	111,511	258,026
10 months ended Oct. 31, 1909	772,298	484,460	287,839	102,302	216,296
Columbus (Ga.) Electric Company:					
October, 1910	46,962	16,924	30,038	17,932	12,106
October, 1909	33,053	18,636	14,417	12,915	1,502
Edison Electric Illuminating Company of Brockton:					
October, 1910	27,665	14,323	13,342	4,770	8,572
October, 1909	25,973	12,165	13,808	3,651	10,157
Fort Wayne & Wabash Valley Traction Company:					
October, 1910	131,360	67,366	63,994	45,829	18,165
October, 1909	122,806	70,386	52,420	42,284	10,135
Galveston-Houston Electric Company:					
October, 1910	113,476	65,937	47,539	25,565	21,974
October, 1909	102,014	64,652	37,362	22,485	14,877
Jacksonville Electric Company:					
October, 1910	48,367	27,088	21,279	9,346	11,933
October, 1909	41,567	22,137	19,430	9,452	9,978
Lake Shore Electric Railway Company:					
October, 1910	105,075	55,940	49,135	34,669	14,465
October, 1909	94,255	49,754	44,505	35,453	9,074
Minneapolis General Electric Company:					
October, 1910	113,157	39,410	73,747	32,351	41,396
October, 1909	94,364	37,520	56,844	31,561	25,283
Norfolk & Portsmouth Traction Company:					
October, 1910	166,776	100,992	65,784	61,098	4,686
October, 1909	156,540	87,974	68,566	62,416	6,150
Northern Texas Electric Company:					
October, 1910	154,007	71,123	82,884	20,290	62,594
October, 1909	135,697	64,595	71,102	16,189	54,913
Pensacola Electric Company:					
October, 1910	23,650	13,578	10,072	5,105	4,967
October, 1909	21,027	12,579	8,648	4,474	4,174
Philadelphia Company, Pittsburgh:					
October, 1910	1,649,892	988,597	661,295	.....	.....
October, 1909	1,646,415	979,208	667,207	.....	.....
Puget Sound Electric Railway:					
October, 1910	161,760	101,079	60,681	50,018	10,663
October, 1909	170,199	110,490	59,609	49,777	9,832
Seattle Electric Company:					
October, 1910	469,033	239,640	229,393	109,913	119,480
October, 1909	544,077	326,200	217,877	102,169	115,708
Sierra Pacific Electric Company:					
October, 1910	49,206	13,844	35,762	6,020	29,342
October, 1909	45,283	18,930	26,353	5,707	20,646
Twin City Rapid Transit Company:					
October, 1910	645,358	308,743	336,615	140,321	196,294
October, 1909	596,963	277,175	319,788	140,251	179,537

General News

Construction News.

TROY, ALA.—A. B. Campbell, superintendent of the water works and electric light plant, is reported to have recommended improvements involving an expenditure of about $10,000.

IMBODEN, ARK.—The Smithville Rural Telephone Company, of Imboden, has purchased the telephone line from Strawberry to Black Rock from Mizer and Peacock, which has been connected with the local system. The company is erecting a new line from Smithville to Black Rock, via Denton, which will soon be ready for operation.

JAMESTOWN, ARK.—The engine-room, coal tipple, electric light plant and other machinery was destroyed by fire at the plant of the Penn Central Coal Company on Nov. 11, causing a loss of about $75,000.

PORTLAND, ARK.—The City Council has engaged Dickinson & Watkins, of Little Rock, Ark., to supervise the construction of the proposed electric light plant, water works and sewer system. The cost of the work is estimated at about $35,000.

CORTE MADERA, CAL.—At a recent election the citizens voted to issue bonds to establish lighting and fire districts in Corte Madera.

LOS ANGELES, CAL.—The Southern California Edison Company has awarded the contract for the erection of the superstructure for its large power plant at Long Beach to the F. O. Engstrom Company, of Los Angeles, for $160,000.

OAKLAND, CAL.—The City Council has granted the Great Western Power Company a franchise to erect and operate an electric light system on the streets in Oakland.

PALO CEDRO, CAL.—Arrangements are being made by Herbert Bass, of Montgomery Creek, president and lessee of the Redding, Ingot & Wengler Telephone Company, for extension of the telephone line.

POINT RICHMOND, CAL.—Announcement has been made by H. B. Kinsey, manager of the Richmond Light & Power Corporation, that the company proposes to reconstruct its system in Point Richmond. The work will include the construction of a new transformer station on the east side of the city, the installation of heavier wire and poles and larger transformers to meet the rapidly increasing demand for electrical service.

RED BLUFF, CAL.—Notice of appropriation of 7000 in. of water in Deer Creek has been filed by Charles L. Crowder, to be used for generating electricity for commercial purposes. The water will be diverted at a point about fifteen miles southeast of Red Bluff.

REDDING, CAL.—The Noble Electric Steel Company expects to resume the production of pig ore at its Heroult electric smelter plant as soon as the Northern California Power Company completes the extensions to its power system.

ROSEVILLE, CAL.—The Roseville Home Telephone Company has applied to the Village Trustees for a fifty-year franchise in Roseville. The company has leased the system of the Pacific States Telephone Company and proposes to improve the service. D. M. Hamish is president and A. W. Dickinson is manager, both of Roseville.

SAN FRANCISCO, CAL.—Owing to the controversy concerning the franchise of the Equitable Light & Power Company in regard to laying pipes in the streets of the city for the transmission of steam heat, the Board of Supervisors has instructed the Board of Public Works to stop all work until the matter has been settled by the courts. The company operates a steam-heating plant in connection with its electric light system.

STOCKTON, CAL.—The Western States Gas & Electric Company, recently organized with a capital stock of $15,000,000, it is reported, will take over the properties of the Stockton Gas & Electric Company, of Stockton, and the Richmond Electric Company, in Contra Costa County.

BOULDER, COL.—The Tungsten Mines Company is contemplating the installation of a motor-driven air compressor. Additional machinery will be required by the company as work progresses on the tunnel that it is now driving.

DENVER, COL.—The Larimer Street Improvement Association is contemplating the installation of an ornamental street lighting system on Larimer Street.

FOWLER, COL.—The Pueblo & Suburban Traction & Lighting Company has applied for a franchise to supply electricity for lamps and motors in Fowler.

PUEBLO, COL.—The Pueblo & Suburban Traction & Lighting Company is planning to erect a 2000-kw power plant, contracts for which will be awarded during the next three months. For further information address T. C. Roberts, of Pueblo, superintendent.

ROCKY FORD, COL.—The Pueblo & Suburban Traction & Lighting Company is reported to have taken an option on the electric light plant in this city, owned by the Rocky Ford Electric Company. It is understood that the company contemplates the construction of a suburban electric railway to the east to connect with La Junta.

BRIDGEPORT, CONN.—It is reported that the Baird Machine Company, of Oakville, Conn., is planning to erect a new plant at Bridgeport, plans for which are being prepared by the Fletcher Engineering Company, of Bridgeport, Conn. A power plant will be erected in connection with the proposed works.

GEORGETOWN, CONN.—The Housatonic Power Company is extending its transmission lines from South Norwalk to Georgetown to supply electricity for lighting the streets and residences of the town. Incandescent lamps will be used for street lighting. It is expected to have the service ready in about three months.

GROTON, CONN.—The New London Ship & Engine Company is contemplating the erection of a new boiler house in connection with the new machine shop at its plant.

PLAINVILLE, CONN.—The Housatonic Power Company has been awarded the contract for lighting the streets of the town for a term of five years. Under the terms of the contract the company will supply 60-watt Mazda electric lamps at $20 each per year.

WASHINGTON, D. C.—The contract for installing lighting and clock system in the Western High School has been awarded to Kluckhuhn & Brother, of Washington, D. C., for $3,115.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 14 for furnishing and installing lighting fixtures in the United States buildings at Beatrice, Neb.; Clifton Forge, Va.; Jackson, Mich.; Belfast, Maine; Bristol, Tenn.; La Crosse, Wis.; Moscow, Idaho; Owensboro, Ky., and San Angelo, Tex.

ATLANTA, GA.—The Augusta-Aiken Railway & Electric Company is contemplating increasing the output of its local power house by 3000 hp.

CEDARTOWN, GA.—George Cooper, of Dallas, Ga., is reported to be interested in a project to develop the water power of Terrapin Creek.

COLUMBUS, GA.—The Columbus Manufacturing Company has recently installed a 1340-hp motor to operate the new addition recently erected at a cost of $500,000.

CUTHBERT, GA.—It is reported that the Cotton Belt Telephone Company contemplates issuing $100,000 in bonds, the proceeds to be used for improvements and extensions to its system.

WAYCROSS, GA.—Announcement has been made by T. H. Calhoun, of Beach, that he will soon apply for a franchise for an independent telephone system in Waycross. If the franchise is granted connecting lines will be erected into Jacksonville, Savannah and other important points in Georgia. Application will be made for a charter at once.

AMERICAN FALLS, IDAHO.—Arrangements are being made for increasing the output of the American Falls plant of the Idaho Consolidated Power Company from 3000 to 30,000 hp, work on which will begin as soon as the weather permits. The plant now provides electricity for lighting the towns of Rockport, Blackfoot and American Falls and other small places in southern Idaho. When the plant is completed it is proposed to extend the service in the southern part of Idaho and also into Utah. James H. Brady, of Pocatello, Idaho, is president of the company.

ATHOL, IDAHO.—The Athol Water & Light Company, recently organized, is reported to be contemplating the installation of a public service plant.

ALBANY, ILL.—S. B. Dimand, J. W. Dinnun, C. E. Peck and James Beach are reported to be interested in a project to build an electric railway through Albany from the tri-cities.

CHICAGO, ILL.—Sealed proposals will be received by the Board of Trustees of the Sanitary District of Chicago, Ill., until Dec. 15 for the following equipment: Division A—Alternating-current generator and rheostat. Division B—Switchboard panels and oil circuit-breaker switches. Division C—Generator and transformer connections. Division D—Transformers. Division E—Turbine water-wheel unit. Plans and specifications are on file at the office of the electrical engineer, 1500 American Trust Building, Chicago, Ill., where blank proposal forms can be obtained. Robert R. McCormick is president of the Board of Trustees.

COAL CITY, ILL.—The McComber & Whyte Wire Rope Company is reported to be making arrangements to operate its factory by electricity, which will be supplied by the Illinois Valley Light & Power Company.

KANKAKEE, ILL.—Sealed proposals will be received at the office of the County Clerk, Kankakee, Ill., until Dec. 21 for furnishing and installing lighting fixtures in the Kankakee County courthouse, in Kankakee, in accordance with plans and specifications, which will be furnished on application to Zachary T. Davis, architect, 1009 Steinway Hall Building, Chicago, Ill.

KEITHSBURG, ILL.—Sealed bids will be received by the Commissioners of the Keithsburg Drainage District, Keithsburg, Ill., until Dec. 9 for furnishing one 18-in. centrifugal pump, one 12-in. centrifugal pump, together with steel plate, rivets, suction and discharge piping, two constant-speed induction motors of sufficient rating to operate the pumps, two Morse or other equally satisfactory chain drives and all auxiliary appurtenances, including motor-driven vacuum pump for priming the main pumps, and also machinery foundations. Jacob A. Harman, of Peoria, Ill., is engineer.

MATTOON, ILL.—The Big Four Railroad is reported to have awarded a contract for the construction of a power house to the Murphy Construction Company, of St. Louis, Mo. It is proposed to increase the output of the present plant to enable it to supply light, power and heat for all departments. The company is contemplating operating its machinery by electric motors.

STREATOR, ILL.—Plans are being considered by the Illinois Light & Traction Company for the construction of an extension of its system from Ridgefarm to Sharon.

TAMAROA, ILL.—The Town Board has granted C. W. Lafferty, of Ashley, Ill., a franchise to install a telephone system in Tamoroa.

EAST CHICAGO, IND.—C. H. Geist, of Philadelphia, Pa., president of the Northern Indiana Gas & Electric Company, is reported to be interested in a project to construct an electric railway from Chesterton to Gary and thence to Whiting. The large power plant of the Northern Indiana Gas & Electric Company at East Chicago is nearly completed. The company is also erecting a substation at Chesterton.

FORT WAYNE, IND.—The Home Telephone & Telegraph Company is planning to replace its present telephone wires with cables on Spy Run Avenue.

INDIANAPOLIS, IND.—The Big Four Railroad is operating 1243 miles of its system radiating from this city by telephone and proposes to extend this service over its entire system.

INDIANAPOLIS, IND.—The Cedar Rapids & Iowa City Railway & Light Company is reported to be contemplating the installation of an automatic track-circuit block signal protection.

INDIANAPOLIS, IND.—Plans are being considered by the Central Union Telephone Company for the erection of two new exchanges in Indianapolis, one to be known as the "Circle" exchange and the other as the "West." A large number of telephones in the central part of the city will be transferred to the "Circle" exchange.

INDIANAPOLIS, IND.—E. V. Hubbard, consulting engineer, of Indianapolis, Ind., who was engaged to make an estimate of the cost of heat, water, light and power plant for the State House, Indiana University School of Medicine and the Soldiers and Sailors' Monument, has submitted a report to Governor Marshall, in which he states that installation of such a plant would cost $105,346. It is said the report will be submitted to the Legislature without recommendation.

LINTON, IND.—The Linton Home Telephone Company is building a new exchange building. New equipment will be installed and other improvements will be made, involving an expenditure of about $20,000.

MOORESVILLE, IND.—The plant of the Public Service Company, B. R. Mowery, receiver, was recently sold at auction to Harry J. Stoops, of Chicago, Ill., for $19,500, the amount of the bonds, which were held by Mr. Stoops. It is understood that the new owner proposes to make extensive improvements to the system.

SEYMOUR, IND.—The Baltimore & Ohio Southwestern Railroad Company is rebuilding its roundhouse and shops in Seymour and installing a large amount of new machinery, which will be equipped for electric motor drive. The company has placed a contract for electricity to operate the machinery in the shops and the large turntable at the roundhouse.

WABASH, IND.—The Citizens' Telephone Company, recently organized, is planning to erect telephone lines in both the city and county. L. A. Barnett is president of the company.

KEOKUK, IA.—The Mississippi Valley Telephone Company, operating exchanges in Keokuk, Burlington, Fort Madison, Muscatine and a number of smaller towns in Iowa, was sold at a foreclosure sale to Webster Brothers, of Minneapolis, Minn., for $175,000. The company has a bonded indebtedness of $175,000.

ODAIR, IA.—At an election to be held Dec. 20 the proposition to issue $10,000 in bonds, the proceeds to be used for the installation of an electric light plant, will be submitted to a vote.

RED OAK, IA.—The Red Oak Electric Company is contemplating extending its transmission line to Stanton, Ia., to supply electricity for lamps and motors in that town.

SIOUX CITY, IA.—The City Council has engaged F. W. Capelen, of Minneapolis, Minn., to prepare plans and estimates for the installation of an electric plant to supply electricity for lamps and motors for the city buildings, fire and police stations, the proposed Morningside subsidiary water station and for pumping from the new wells that are being installed.

WEBSTER CITY, IA.—The Commercial League is promoting the construction of a dam across the Boone River, as recommended by A. C. Miller, chairman of the Iowa State Drainage, Waterways and Conservation Commission, the cost of which is estimated at from $150,000 to $200,000.

HUTCHINSON, KAN.—The Medora Telephone Company has purchased the independent telephone line between Medora and Buhler, formerly owned by the Burns system. R. E. Calbert and H. J. Pickens, of Medora, are interested in the Medora company.

MANHATTAN, KAN.—Plans are being considered by the Manhattan City & Interurban Railway Company for the extension of its railway to Fort Riley, a distance of sixteen miles.

PAOLA, KAN.—The People's Electric Light Company, recently organized with a capital stock of $15,000, is building an electric light plant in Paola. The power house is nearly completed and the machinery will soon be installed. It is expected to have the plant in operation about Jan. 1, 1911.

SALINA, KAN.—The Salina Street & Interurban Railway Company is contemplating extending its railway in Salina. H. C. Smithers is president.

TOPEKA, KAN.—A special committee has been appointed by the Commercial Club to take steps to secure a new lighting system for the business section of the city. It is proposed to erect lamp standards carrying clusters of 500-cp tungsten lamps at intervals of 50 ft. on both sides of Kansas Avenue in the district between Gordon and Tenth Streets, the business men and property holders to provide the equipment and the city to supply electricity for same.

TURON, KAN.—The Commercial Club is reported to be interested in a project to install an electric lighting system in Turon.

CALHOUN, KY.—The Green River Light & Water Company has increased its capital stock from $10,000 to $20,000.

CLAY CITY, KY.—Arrangements are being made by the Clay City Telephone Company for the erection of an independent telephone line from Clay City to Hazel Green, via Rothwell, a distance of twenty-five miles, work on which will begin within thirty days.

CORNETTSVILLE, KY.—The Big Leatherwood Telephone Company is contemplating the erection of a telephone line from Cornettsville to Banks, via Line Fork, twenty miles in length.

INDIAN BOTTOM, KY.—The Lower Rockhouse Telephone Company, recently organized, is planning to erect a telephone line from Indian Bottom to Gourd, via Isom. James Brown is manager.

LEXINGTON, KY.—A. G. Morgan, 244 North Broadway, Lexington, is reported to be contemplating the construction of an electric light plant.

PADUCAH, KY.—Preparations are being made by the Paducah Traction Company to extend its railway to Tyler, Mechanicsburg and Fisherville. Application for franchises in the different cities have been made.

PIKEVILLE, KY.—The Eastern Kentucky Home Telephone Company is reported to be planning the erection of telephone lines from Pikeville to Brush Creek, a distance of eighteen miles. N. Starkey, of Pikeville, is manager.

DONALDSONVILLE, LA.—It is reported that the Lafourche Valley & Gulf Railroad Company is planning to install telephone and telegraph systems for train dispatching.

BALTIMORE, MD.—Arrangements are being made by the Consolidated Gas, Electric Light & Power Company for the construction of a large addition to its substation on McClellan's Alley, near Baltimore Street.

BALTIMORE, MD.—Plans are being considered by Booz Brothers for the improvements to their ship repair yard, including the installation of a special electric double-chain lifting device, having a lifting capacity of 2000 tons, for service in connection with their marine railway.

BALTIMORE, MD.—Plans have been prepared by Otto G. Simonson for the erection of a manufacturing plant for the Simpson-Doeller Company, Patuxent and Preston Streets, Baltimore, Md., for which, it is said, estimates are now being received. A power plant to provide both steam and electricity will be installed.

BALTIMORE, MD.—It is reported that plans have been submitted to contractors for the construction of a new factory building for Becker Brothers & Sons, Frederick and Lexington Streets. The mechanical equipment will include engines, boilers, electric lighting plant, elevators and conveyors. A sprinkler system will be installed.

BALTIMORE, MD.—Bids will be received by the Board of Awards until Dec. 14 for furnishing both pole type and subway type oil-cooled transformers for the public parks and squares of Baltimore, in accordance with specifications, which can be obtained at the office of the board of Park Commissioners, Druid Hill Avenue entrance to Druid Hill Park, Baltimore, Md. William S. Manning is general superintendent.

FREDERICK, MD.—Announcement has been made that the control of the Frederick Gas & Electric Company has passed into the hands of the Frederick Railroad Company. Emory L. Coblentz is president of the railroad company.

PITTSFIELD, MASS.—Announcement has been made by the Pittsfield Electric Company of a reduction in the price of electricity for lamps from 17 cents per kw-hour to 14.4 cents per kw-hour, beginning with Jan. 1, 1911. No reduction will be made in the rates for power service.

SOUTH FRAMINGHAM, MASS.—The Ames Plow Company has acquired a site in South Framingham, near the New York, New Haven & Hartford Railroad, on which it will erect a plant for the manufacture of plows, agricultural vehicles and wheelbarrows and other farming implements. A power plant will also be erected to provide electricity for operating the plant, which will be equipped for electrical operation. Complete electrical equipment will be required, including motors and transmission for electric driven units. Between $30,000 and $40,000 will be expended for the new equipment. The company's factory is now located in Worcester, Mass., and the main offices are in the Quincy Market, Boston, Mass.

STERLING, MASS.—At a special town meeting held recently the citizens voted to authorize the Selectmen to install an electric light system in Sterling, the cost not to exceed $6,000.

BIG RAPIDS, MICH.—D. H. Vincent, superintendent of the municipal water works plant, has been authorized to secure plans and estimates

for the installation of an auxiliary steam power plant, to be used in case of accident to the hydroelectric equipment.

MARQUETTE, MICH.—Plans are being considered for extensive improvements to the municipal electric light plant, including the rebuilding of the Silver Lake dam.

MUSKEGON, MICH.—A syndicate, headed by F. R. McMullen, of Chicago, Ill., is reported to have purchased the property and rights of the Interurban Light & Power Company in Mason County. The company, it is said, proposes to construct three dams in connection with its extensive hydroelectric development to supply electricity for lamps and motors in the region around Hamlin Lake, and for an electric railway to be built from Muskegon to Manistee. Plans, as yet, have not been completed.

CLOQUET, MINN.—The Cloquet Electric Company has been granted a franchise to extend its transmission line from Cloquet to Moose Lake.

ELBA, MINN.—An electric light plant is being installed in Elba. L. Todd is reported to be interested in the project.

FAIRMOUNT, MINN.—Contracts have been awarded by the City Council for improvements to the municipal electric light and water plant amounting to a little more than $30,000, as follows: To the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., for 400-hp engine, at $21,985; for pump, motor, etc., to the Allis-Chalmers Company, of Milwaukee, Wis., for $2,885, and for the erection of new tower and tank, to the Des Moines Bridge & Iron Works, of Des Moines, Ia., for $5,372. Electricity for operating the pump will be supplied from the electric plant.

LONG PRAIRIE, MINN.—The municipal electric plant was recently damaged by an explosion of the boiler, causing a loss of about $1,500. The business men are urging the installation of a plant to provide for a twenty-four-hour service.

MINNEAPOLIS, MINN.—The Council water committee has awarded the contract for two electrically driven centrifugal pumps of 20,000,000 gal. daily capacity for the northeast pumping station to Henry R. Worthington, of New York, N. Y., for $28,612.

MINNEAPOLIS, MINN.—An appropriation of $250,000 for the high dam between Minneapolis and St. Paul is recommended by the chief engineer in his annual report to Congress. This is in addition to the unexpected balance in the treasury in January, 1910. It is proposed to expend the amount appropriated for the fiscal year of 1912 toward completing the lock to height required to commence work on construction of the dam.

PIPESTONE, MINN.—It is reported that George R. Griffith, who has been granted a twenty-year franchise and contract for street lighting, will install a plant, work on which will begin immediately.

SANTIAGO, MINN.—The Santiago-Blue Hill Telephone Company is building a branch line to Glendorado.

ST. PAUL, MINN.—Surveys have been completed by the St. Paul Railway Promotion Company for the construction of an electric railway, which will connect St. Paul, Mankato, Eagle Lake, Faribault, Northfield and other southern Minnesota cities. W. L. Sontag, 810 Metropolitan Building, St. Paul, Minn., is general manager.

THIEF RIVER FALLS, MINN.—Plans are being considered by the City Council for the construction of a dam across the Red Lake River, four miles south of the city, in the spring. An electric light and power plant will also be installed.

BUTLER, MO.—S. W. Dooley, A. H. Culver and associates are reported to be interested in a project to build an electric railway through Butler.

IRONDALE, MO.—It is reported that James P. Ward, construction engineer, is contemplating the construction of a hydroelectric power plant in connection with an electric railway.

JEFFERSON CITY, MO.—The contract for the construction of the proposed electric railway, which will cover the entire city, has been awarded to Waddell & Harrington, of Kansas City, Mo. C. W. Thomas, of Jefferson City, Mo., is interested in the project.

JOPLIN, MO.—The Southwest Missouri Electric Railroad Company, of Webb City, Mo., is building a substation in Joplin. The cost of the plant including machinery will be about $20,000.

MEXICO, MO.—Contract has been awarded by the Mexico, Santa Fe & Perry Traction Company to the Heintz-Young Construction Company, of St. Louis, Mo., for the construction of its proposed railway from Mexico to Hereford, a distance of twenty miles. Mathias Crum is president.

SEDALIA, MO.—Plans are being considered by the Home Telephone Company for the reconstruction of its local system, including the erection of a new telephone exchange.

DILLON, MONT.—The Gillmore & Pittsburg Telephone Company is reported to be erecting a metallic telephone line to connect Salmon, Leadore and Gilmore, Idaho, and Armstead, Mont. A switchboard will be installed in each of the towns and ranchers along the lines will be given connection with the main line. About 300 miles of wire will be erected.

GREAT FALLS, MONT.—Plans are being considered by the Regal Mountain Coal Mining Company, of Great Falls, for the construction of an ore concentrating mill and cyanide plant on People's Creek. It has not yet been decided whether to install steam pump equipment or to secure electricity from a hydroelectric power plant recently established in this vicinity.

MUSSELSHELL, MONT.—Handel Brothers are reported to be interested in a project to install an electric light plant in Musselshell.

PLENTYWOOD, MONT.—The Montana Star Telephone Company is contemplating the construction of an exchange building in Plentywood.

DAVID CITY, NEB.—James Bell, owner of the local electric light plant, has secured a temporary injunction against the Mayor and Council of David City restraining them from proceeding with the construction of a municipal electric light plant. When the citizens voted bonds for the construction of a municipal electric light plant Mr. Bell offered to sell his plant to the city, the value to be determined by arbitration. His proposition did not meet the approval of the city authorities. The matter will now be settled by the courts.

PALISADE, NEB.—It is reported that work has commenced on the construction of the power house for the new electric light plant in Palisade.

WYMORE, NEB.—The proposition to issue $57,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant and water works system, will soon be submitted to a vote.

GARFIELD, N. J.—At an election held Nov. 15 the citizens voted to issue $125,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant in Garfield.

MENDHAM, N. J.—The citizens have decided to install an electric light system in Mendham. It is expected to have the streets lighted by electricity within a short time.

NEWARK, N. J.—Work has commenced on the installation of electric light and power plant at the court house, contract for which was recently awarded by the Board of Freeholders to the Watson Flagg Company for $26,495.

PLAINFIELD, N. J.—Bids will be received by the Common Council until Dec. 19 for furnishing and erecting two pumping plants, complete, including motors, compressors and ejectors in duplicate, air receivers and pipe connections, erected complete, for the sewage pumping plant. Plans and specifications can be seen and forms of proposals and specifications can be obtained at the office of Andrew Gavett, city surveyor, 115 North Avenue, Plainfield, N. J.

WASHINGTON, N. J.—The Easton & Washington Traction Company has awarded the contract for the construction of the extension of its railway from Port Murray to Hackettstown, N. J., to M. P. McGrath.

ROSWELL, N. M.—The Roswell Gas & Electric Company has agreed to extend its transmission line to the entrance of the South Park Cemetery, a distance of about one and one-fourth miles. The cost is estimated at from $1,200 to $1,600.

ALBANY, N. Y.—Sealed proposals will be received by the Trustees of Public Buildings, Capitol, Albany, N. Y., until Dec. 21, for construction and plumbing and conduits for the New York State Capitol and Education Building at Albany. Drawings and specifications are on file at the office of Franklin B. Ware, Albany, N. Y., where plans and specification may be obtained on application before Dec. 16.

BROOKLYN, N. Y.—Sealed proposals will be received by the State Commission in Lunacy, Capitol, Albany, N. Y., until Dec. 14 for alterations in main building construction, including plumbing and electric work, at the Long Island State Hospital, Brooklyn, N. Y. Plans and specifications may be seen and blank forms of proposals obtained at the Long Island State Hospital, Brooklyn, N. Y.; at the office of the State Commission in Lunacy, No. 1 Madison Avenue, New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany N. Y., where plans can be obtained on application. T. E. McGarr is secretary of the State Commission in Lunacy.

MIDDLETOWN, N. Y.—Work on the addition to the West Main Street power plant of the Orange County Lighting Company is nearly completed. Two 320-hp Babcock & Wilcox boilers have been installed, together with a Jeffrey coal conveyor and Maris traveling crane. A 650-hp Ball & Wood engine, together with a General Electric generator, is now being installed. The generating capacity of the power plant will be increased to 1300 hp. The company will hold the plant on Monhagen Avenue, formerly operated by the Consumers' Light & Power Company as an auxiliary plant, for use in emergencies. Electricity can also be secured from the plant of the Neversink Power Company at Cuddebackville.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 12, for the installation of an electric motor and pump at Public School No. 4, located at Fulton and Third Avenues and 173d Street, Borough of the Bronx.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, until Dec. 12 for alterations and additions to the electric equipment in Public School No. 36, 710 East Ninth Street, and Public School No. 47, 225 East Twenty-third Street, plans and specifications for which may be seen at the office of the Board of Education, Park Avenue and Fifty-ninth Street.

NEW YORK, N. Y.—Bids will be received by Calvin Tomkins, Commissioner of Docks, Department of Docks and Ferries, Pier "A," foot of Battery Place, North River, New York, N. Y., until Dec. 12 for furnishing materials and labor required for changing the present arc lighting system to a tungsten lamp system on the recreation piers. Blank forms and other information may be obtained at the office of the Dock Department.

ROCHESTER, N. Y.—Plans are under consideration for making further improvements to the street lighting system in Rochester.

ROCHESTER, N. Y.—It is reported that the Rochester Railway & Light Company is planning to install 200 more illuminated fire alarm boxes by next spring. At present there are about 100 in the city.

ROME, N. Y.—The Rome Home Telephone Company has applied to the City Council for a franchise to build a subway on Washington Street with branches for the purpose of placing its wires underground. The company contemplates extensive improvements to its system, including the erection of a new building, placing its wires underground, etc., which will involve an expenditure of from $50,000 to $65,000.

SILVER LAKE, N. Y.—Preparations are being made by the village of Silver Lake for the construction of an electric light plant and waterworks pumping station for artesian well supply in Silver Lake.

SILVER SPRINGS, N. Y.—The proposition to authorize the Village Board to issue $6,000 in bonds, the proceeds to be used for the installation of an electric light system, was carried at a recent election.

SALUDA, N. C.—The Saluda Telephone Company has been chartered with a capital stock of $1,000.

GRAHAM, N. C.—It is reported that the River Falls Cotton Mills Company is planning to build its proposed plant at River Falls, N. C. The equipment will include 10,000 spindles and 240 looms. A hydroelectric power plant will be installed to furnish electricity for lighting and operating the mill. It is understood that contracts have already been awarded. J. W. Menefee, of Graham, N. C., president and treasurer.

BERTHOLD, N. D.—John I. Moore, of Minot, N. D., is reported to have been granted a franchise to construct and operate an electric light plant in Berthold. It is expected to have the plant ready for operation early in February.

AKRON, OHIO.—Plans have been completed by the Northern Ohio Traction & Light Company for the construction of a new power plant to be located on what is known as the Gorge Bridge, on the Cuyahoga River, which will include the construction of a dam. It is expected that work will begin on the new building during 1911. The cost of the proposed plant is estimated at $1,500,000.

AKRON, OHIO.—Steps have been taken by the directors of the Northern Ohio Traction & Light Company toward the organization of the Northern Ohio Power Company, which will control the new power plant to be erected in the near future, at a cost of approximately $1,500,000. The new company will be capitalized at $3,000,000 and bonds to the amount of $3,000,000 will be issued. It will be controlled by interests connected with the Northern Ohio Traction & Light Company. Plans are nearly completed for the power plant to be located in the vicinity of Cuyahoga Falls.

ASHLAND, OHIO.—The Star Telephone Company has filed amendments to its charter increasing its capital stock from $100,000 to $150,000.

CANTON, OHIO.—Sealed bids will be received by the Director of Public Service, Canton, Ohio, until Dec. 14 for furnishing and installing one double triplex power pump having a capacity of 2,000,000 gal. per twenty-four hours, direct-connected to a 150-hp alternating-current motor set on foundation furnished by the city. Bids will also be received for horizontal centrifugal pump in one or in two units. Bids will also be received at the same time and place for one 250-hp compound condensing steam engine direct-connected to a 150-kva, alternating-current generator and exciter with switchboard, also condenser for engine, and also for a 325-hp engine and 200-kva alternating-current generator. Bids will also be received for gas engines and generators of same rating as above. Ray F. Harbert is director of public service.

CLEVELAND, OHIO.—The capital stock of the Hardin-Wyandot Lighting Company has been increased from $10,000 to $500,000.

GALLIPOLIS, OHIO.—Negotiations are about completed for the consolidation of the exchange of the Gallipolis Telephone Company with the system of the Central Union Telephone Company. The former company has been in the hands of a receiver for some time.

LANCASTER, OHIO.—Sealed proposals will be received by the Board of Trustees of the Boys' Industrial School, Lancaster, Ohio, for installing additional compressor piping, etc., for the light, heat and power plant at the Boys' Industrial School. F. C. Gerlach is secretary of the board.

MT. VERNON, OHIO.—The Mt. Vernon Electric Company, recently incorporated, and which has taken over the plant and holdings of the Mt. Vernon Railway & Light Company, is reported to be contemplating extensive improvements to the system.

TOLEDO, OHIO.—The Council committee on public improvements has approved an ordinance repealing a grant made to the Harrison Telephone Company in May, 1894, to lay conduits in the business section of the city. The ordinance provided that if an attempt was made to turn the rights over to a competing company the ownership of the conduits would at once revert to the city. The rights and use of the conduits have been turned over to the Bell Telephone Company. The conduits are said to be worth $75,000, and the city authorities demand at least an annual rental of $5,000 for the property.

ALTUS, OKLA.—The Alfalfa Irrigation Company, which is planning to install an extensive irrigation project in this region, will require power machinery, pumping units, etc.

HYDRO, OKLA.—The town of Hydro has voted to issue $25,000 in bonds, the proceeds of $20,000 to be used for the installation of a waterworks system and $5,000 for electric lighting. As yet the bonds have not been sold. For further information address C. A. Chambers, of Hydro, Okla.

STILLWELL, OKLA.—The question of issuing $40,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system, will soon be submitted to a vote.

ADEL, ORE.—The contract for constructing a telephone line from Adel to Plush, a distance of twenty miles, has been awarded to the Lake View-New Pine Creek Electric Company. It is proposed to install a switchboard at Adel for the use of the branch lines. A system will soon be installed in Bidwell and an exchange established there.

BEND, ORE.—The electric plant of the Bend Water, Light & Power Company has been completed and placed in operation. The initial installation provides for about 260 hp. Arrangements have been made for installing additional units as required. The city has contracted for ten arc lamps to be placed on the streets in the business section. Provision will be made for lighting the residence districts in the near future. The plant is located on the Deschutes River.

PORTLAND, ORE.—The Portland Railway, Light & Power Company is planning to erect a new substation in the Mount Tabor district, and the purchase of three 3300-kw, 60-cycle generators for the Estacada plant. F. I. Fuller is vice-president.

THE DALLES, ORE.—Work has begun on the construction of an electric railway in The Dalles. The proposed railway will reach all parts of the city and extend into the surrounding country in every direction. Frank P. Phillips has the contract for construction of the road. W. Thomas is interested in the project.

ERIE, PA.—The installation of a pumping engine of 20,000,000 gal. daily capacity is under consideration by the city officials. The water commissioners will visit plants in other cities with a view of deciding upon style of equipment to purchase.

FREELAND, PA.—The new plant of the Harwood Electric Heating & Power Company has been completed and put in operation. The company will supply electricity for operating the machinery in the mines and industrial plants in the vicinity.

LANCASTER, PA.—The C. H. A. Dissinger & Brother Company, of Wrightsville, Pa., is reported to be erecting a plant in Lancaster, including a foundry, pattern shops, cleaning-rooms, etc. The company proposes to manufacture its Capital line of gas and gasoline engines. An electric generating plant will be installed to provide electricity for operating the plant, which will be equipped for electric motor drive.

PHILADELPHIA, PA.—It is reported that plans and estimates are being prepared by Irwin & Leighton for the erection of a power house for the Chalfont Brothers, at Forty-fourth and Thompson Streets.

PITTSBURGH, PA.—The West Penn Railways Company is making extensive improvements to its Connellsville power house, which will double the output of the plant. The company, it is reported, will eventually build a new power station near Speers.

SCHUYLKILL HAVEN, PA.—Bids will be received at the office of the County Controller of Schuyler County, Pottsville, Pa., until Jan. 17 for construction of a building for the insane at Schuylkill Haven, Pa., including increased water supply, sewage disposal plant, power plant, elevator, heating, ventilating, plumbing and electric wiring complete, in accordance with drawings and specifications, copies of which can be obtained at the office of the County Commssioners, after Dec. 16, on payment of $30 to cover the cost of printing the same. Charles T. Straughn is County Controller.

WOMELSDORF, PA.—George W. Bright, secretary, writes that it is proposed to install new water wheel in the borough electric light plant.

WOONSOCKET, R. I.—It is reported that the Stone & Webster Engineering Corporation, which operates the property of the Woonsocket Electric Machine & Power Company, is contemplating the construction of a concrete dam in Woonsocket next spring.

YORKVILLE, S. C.—Plans and proposals will be received by the town of Yorkville, S. C., until Dec. 15 for mechanical gravity filtration plant with a capacity of from 250 to 300 gal. per minute, including loss of head gages, controllers, pump and motor belts, pulleys, etc.

CARBONATE, S. D.—Plans are being prepared by the Black Hills Development & Financial Corporation for the construction of a 300-ton ore reduction plant, including smelter, at Carbonate S. D., next spring. It is also proposed to install a large electric power plant in the coal fields of Wyoming, just across the State border.

PHILIP, S. D.—Arrangements are being made by the Great Western Telephone Company for reconstructing its exchanges in Philip and Midland. The company may erect exchanges in several small towns between those places. It is now building a toll line out of Fort Pierre.

KNOXVILLE, TENN.—The Appalachian Marble Company, which is constructing a plant in Lonsdale, it is said, will require considerable new machinery, including a large electric crane.

CLARKSVILLE, TEX.—Preparations are being made by the Clarksville Light Company for rebuilding its plant, recently burned. It is understood that bids for installation of machinery will be received about Dec. 16. E. C. O'Neil is manager.

COLORADO, TEX.—Arrangements are being made by the Colorado Salt Company for the erection of a new power house, brick, concrete and steel construction, plans for which have been prepared by Sanguinet & Staats, Fort Worth, Tex. The equipment will include industrial track and coal cars and elevator to hoist industrial cars, loaded, twenty-five feet. Bidders are to apply to architects for plans and specifications and submit bids to the Colorado Salt Company.

CORPUS CHRISTI, TEX.—Preparations are being made by the Corpus Christi & Interurban Railway Company to build an extension of its railway from Corpus Christi to the Epworth League grounds.

QUANAH, TEX.—The Southwestern Telephone Company is planning to make improvements to its local system, including the installation of a common battery system, at a cost of about $12,000.

SAN ANTONIO, TEX.—It is reported that A. Y. Walton, Jr., Terrell Bartlett, Willis Ranney and Duval West, of San Antonio, Tex., are interested in a large irrigation project. It is said that they have filed on all the unappropriated waters of the Medina River and its tributaries in Texas, comprising a watershed of about 700 square miles. It is proposed to irrigate about 150,000 acres of land, for which a large amount of pumping machinery will be required.

WACO, TEX.—The Citizens' Railway Company is planning to increase the output of its power plant by the installation of a 1500-kw steam turbine with condensing apparatus, bids for which, it is said, will be received through the National Light & Improvement Company, Pierce Building, St. Louis, Mo. Judson H. Boughton, of St. Louis, Mo., is secretary.

BRIGHAM CITY, UTAH.—Plans are being considered by the City Council for the installation of a hydroelectric power unit, consisting of a hydraulic turbine of the reaction type and an alternating-current generator.

BOWLING GREEN, VA.—The capital stock of the Caroline County Telephone Company has been increased from $15,000 to $20,000.

HERNDON, VA.—J. Harrison Yates is reported to be interested in a proposition to install an electric light plant of sufficient output to supply electrical service to a population of about 1000. As yet no machinery has been purchased.

PETERSBURG, VA.—The Virginia Railway & Power Company has awarded the contract for remodeling the library building for a substation to G. B. Keeler & Son. The cost of the work is estimated at $17,000.

SOUTH BOSTON, VA.—The South Boston Electric Light & Power Company is reported to be negotiating with New York capitalists for the development of Hyco Falls water power, on Dan River, thirty-five mi s east of South Boston The present plans include the construction of a dam and power house to develop 14,000 hp for transmission to South Boston, Henderson, Durham and Roxboro in North Carolina. Stanford B. Lewis, 27 William Street, New York, N. Y., is reported to be interested in the project.

BELLINGHAM, WASH.—A new electric elevator is to be installed in the addition to St. Joseph's Hospital, in Bellingham, at a cost of $2,000.

BELLINGHAM, WASH.—H. A. Whitney, city engineer, is advocating the establishment of a municipal electric light plant, to cost about $200,000.

BELLINGHAM, WASH.—The Bellingham Manufacturing Company, it is reported, is planning to install a plant for manufacturing berry crates, boxes and baskets. An electric plant will be installed to supply electricity for lighting and operating the plant.

CONCONULLY, WASH.—It is reported that the Okanogan Irrigation & Improvement Company is contemplating extensive development work in this vicinity, which will include the installation of electric-driven pumping units.

CONCRETE, WASH.—Plans are being considered for enlarging the plant of the Washington Portland Cement Company. The proposed improvements will cost about $300,000 and include the erection of six steel and corrugated iron buildings, extensions to the power plant and installation of new units in the main grinding and tube mills.

COWICHE, WASH.—The Cowiche Telephone Company, it is reported, will extend its telephone line to the Tieton tunnel, a distance of six miles, and then to the south several miles. Anson S. White is president and general manager.

EVERETT, WASH.—The Everett Business Men's Association has recommended that a system of cluster lamps be installed in the business district.

EVERETT, WASH.—The Everett Railway, Light & Water Company has been granted permission to install a system of cluster lamps on Hewitt Avenue.

MUKILTEO, WASH.—The Crown Lumber Company is reported to be installing an electric light plant at its mills in Mulkilteo.

RENTON, WASH.—The Renton Independent Telephone Company has been granted a franchise to erect a telephone line from O'Brien to Orilla.

SPOKANE, WASH.—Investigations are being made by Prof. I. F. Elsom in the old Placer field in Idaho for the Puget Sound, Chelan & Spokane Railway Company, with a view of extending the electric transmission line to a point near Elk City, Idaho. W. W. Shent is president.

SPOKANE, WASH.—The Spokane, Portland & Northern Railway Company, recently incorporated, is reported to be preparing to begin work on the construction of its proposed electric railway, which will extend from Spokane to the international boundary near Nighthawk, about the first of the year. A. M. Dewey, of Spokane, Wash., is interested in the project.

TACOMA, WASH.—The contract for building the upper portion of the Nisqually power system has been awarded to Messrs. Savage & Nichols, which includes the construction of a dam in the Nisqually River and a 10,000-ft. tunnel. It is understood that the contract for the erection of the transmission line will soon be awarded.

BAYFIELD, WIS.—Plans are being considered for the construction of an extension to the boiler house of the municipal power and pumping station in Bayfield, Wis., work on which will begin in the spring. It is understood that two new boilers will be installed.

GRAFTON, WIS.—The Grafton Light, Heat & Power Company, recently incorporated, is reported to be making arrangements for the installation of an electric light plant in Grafton, and is in the market for equipment for same.

MADISON, WIS.—The Wisconsin Power Company has increased its capital stock from $1,000,000 to $3,000,000. The company owns a large water power dam at Kilbourn City.

MAIDEN ROCK, WIS.—Steps have been taken by the Village Council for the installation of a municipal electric light system in Maiden Rock.

MERRILL, WIS.—The Wisconsin Telephone Company is planning to install a new switchboard and make improvements to its local service.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is making extensive additions to its Commerce Street station, including the installation of two 14,000-kw and two 7500-kw Curtis turbo-generator sets, additions to boiler plant and auxiliary equipment. The plant has an output of 20,000 kw.

WHITEWATER, WIS.—The Badger Railway, Light & Power Company, which proposes to construct an electric railway to connect Whitewater and Lake Geneva, also proposes to establish an electric generating plant at Whitewater, to supply electricity for lamps and motors in this village.

WILTON, WIS.—The Wilton Light & Power Company, recently incorporated, has been granted a franchise to construct and operate an electric light plant in Wausau.

CALGARY, ALTA., CAN.—Bids will be received by the City Commissioners until Dec. 22 for furnishing one 1500-hp synchronous motor-generator, one motor generator exciter set, including switchboard instruments, etc. W. L. Spence is city clerk.

ROCHE POINT, B. C.—The Red Fir Lumber Company is planning to build a new cedar mill in Roche Point, at a cost of about $100,000, which will be equipped for electric motor drive.

WINNIPEG, MAN., CAN.—Under a decision handed down by the Court of Appeals the Winnipeg Electric Railway Company must remove all poles on the city streets, other than those used for its electric railway. The Court of Appeals also found that the company had not violated its charter right by generating electricity at Lac du Bonnet for its street railway lines, but the company cannot supply energy from the Lac du Bonnet plant for other purpose than operating its railway lines without permission from the city.

BROCKVILLE, ONT., CAN.—The municipal electric light and gas plant has been operated by the municipality for ten years. According to the report of the commission the city has received $59,158 since 1900, during that time $27,348 has been written off and $14,901 expended for repairs. The net surplus for the ten years has been $11,402.

HAMILTON, ONT., CAN.—The City Council has decided to ask the Hydro-Electric Power Commission to extend the time in which the City of Hamilton may take a co-operative contract with the commission and other municipalities, instead of a limited contract for 1000 hp from Dec. 31, 1910, to Dec. 31, 1911. Last year the Council decided not to bind the city completely to the Hydro-Electric Power Commission, but only to the extent of 1000 hp, reserving the right to contract for power with other companies. The commission, however, gave the city until Dec. 31, 1910, to decide whether it would come entirely into the project of the commission, along with other municipalities, or stay out entirely.

LONDON, ONT., CAN.—The London Electric Light Company, Ltd., has submitted three propositions to the City Council offering to sell its property to the city. The sub-committee of the City Council has passed a recommendation that the Council prepare and submit to the ratepayers a by-law authorizing the purchase of the plant submitted under proposal No. 3, under which the company offers to sell the city all rights, franchises, plant and equipment (excepting meters, transformers, lightning arresters, arc lamps, etc.) for $100,000, the city assuming the bonded indebtedness of the company. It is expected that the by-law will be submitted to the ratepayers in January. The transmission line of the Hydro-Electric Power Commission has been completed to London and it is expected to utilize the service within a short time.

NIAGARA FALLS, ONT., CAN.—W. D'Arcy Ryan, electrical engineer, has submitted a report to the committee in charge of the Cataract illuminating project, in which he estimates the cost of installing a plant at $70,000. He states that 700 hp would be required for the project. All the batteries will be installed on the Canadian side.

PORT ARTHUR, ONT., CAN.—The Port Arthur & Fort William Railway Company is contemplating the purchase of a 500-kw motor generator set during the next six weeks.

PORT ARTHUR, ONT., CAN.—Electricity is now being received in Port Arthur direct from Kakabeka Falls from the transmission line built by the Ontario Hydro-Electric Commission, under a contract made about ten months ago. At present 600 hp is being received. It is expected to have the substation completed by Dec. 15, when energy from the hydro-electric system will be supplied throughout the city.

PRESTON, ONT., CAN.—The transmission lines of the Hydro-Electric Power Commission have been extended to Preston and are supplying electricity for operating the local system. The street lighting system consists of 200 incandescent street lamps.

TORONTO, ONT., CAN.—The Board of Control has instructed the City Solicitor and City Engineer to prepare plans, specifications, estimates, etc., to enable the city to advertise for tenders for the construction and operation of an underground railway along Queen Street, from the city hall to Sunnyside, with any underground, elevated or surface extensions which they consider would be immediately practicable.

MONTREAL, QUE., CAN.—Arrangements are being made to remove all gas lamps in the city streets and replace them with electric incandescent tungsten lamps. In certain district the gas lamps will be replaced with electric arc lamps. It is expected to have the gas lamps removed by Dec. 31.

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company has secured an interlocutory injunction against the town corporation of Maisonneuve and the Dominion Light, Heat & Power Company, enjoining the latter from maintaining electric transmission lines within three feet of the Montreal company's wires in Maisonneuve.

MONTREAL, QUE., CAN.—The East Canada Power & Pulp Company has awarded the contract for the construction of a large water-power development and pulp mill on the Malbaie River, above Murray Bay, eighty-seven miles east of Quebec, to the Bishop Construction Company, of Montreal, Que. The cost of the work is estimated at $500,000.

MONTREAL, QUE., CAN.—The Montreal & Southern Counties Electric Railway Company has taken over the old Central Vermont Railway, operating between Chambly and Richelieu, and is now equipping the railway for electrical operation. It is understood that the Montreal & Southern Counties Electric Railway Company has applied for permission to operate its cars on the tracks of the Montreal Street Railway Company from the city limits into Victoria Square in the business section. The railway company has made arrangements to secure electricity from the Timothée plant of the Canadian Light, Heat & Power Company.

SHERBROOKE, QUE., CAN.—The City Council has decided to erect a power plant on the Magog River, where it is estimated that about 2600 hp can be developed, at a cost of about $70,000. The Council has also decided to call for tenders for the purchase of the water rights, which the city owns on the St. Francis River, at Westby.

SHERBROOKE, QUE., CAN.—Bids will be received by the City of Sherbrooke until Dec. 28 for the construction of a concrete dam and power house in the Magog River, near Rock Forest. Plans and specifications may be seen at the office of F. J. Griffiths, secretary and treasurer, and at the office of Ross & Holgate, engineers, 80 St. Francis Xavier Street, Montreal, Que., Can.

New Industrial Companies.

THE AUTOMATIC APPLIANCE COMPANY, of Boston, Mass., has been incorporated with a capital stock of $300,000 for the purpose of manufacturing and dealing in all kinds of mechanical and electrical machinery. The directors are: F. H. Whitman, president; Adams D. Claflin, treasurer, and R. L. Whitman.

THE AUTOMATIC SPARK ARRESTER COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $50,000. The company proposes to manufacture machinery, tools, etc. The incorporators are: E. Brombacher, R. J. Lehner and A. Winters, all of Buffalo, N. Y.

THE COLUMBUS ELECTRIC COMPANY, of Columbus, Ohio, has been incorporated by W. S. Smith, W. F. Felton, G. W. Wolfly, J. M. Davis and E. B. Taylor. The company is capitalized at $125,000 and will manufacture and sell an electrical scale, which heretofore has been manufactured by the Columbus Electric Scale Company. The old company will still own the patents and receive a royalty from them.

THE FRENCH FLUID ELECTRIC RHEOSTATS COMPANY, of Portland, Maine, has been incorporated with a capital stock of $10,000 for the purpose of manufacturing and dealing in electric apparatus. The officers are: E. Roy Monroe, of Portland, Maine, president, and Philip A. Hanson, of Portland, Maine, treasurer.

THE LEONARD ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 for the purpose of doing a construction engineering business. The incorporators are: J. Heerin, of Rochelle Park, N. J.; William S. Callendar, of Brooklyn, N. Y., and J. R. Swan, of New York, N. Y.

THE M. & L. MACHINERY & ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing machinery, etc. The incorporators are: P. Wohistetter, S. A. Fuchs and A. Felger, of New York, N. Y.

THE NORTH AMERICAN ELECTRICAL MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing electrical machinery, etc. The incorporators are: John T. Milligan, 248 Emerson Place, Brooklyn, N. Y.; Percival E. Wye, 164 Front Street, and Henry M. Kidder, 38 West Ninth Street, New York, N. Y.

THE PREMIER VACUUM CLEANER COMPANY, of Cleveland, Ohio, has been organized for the purpose of manufacturing a portable electric suction cleaner. The officers are: Charles A. Kolp, of Canton, president; R. E. Hyde, secretary; F. J. Miller, treasurer, and E. L. Frantz, manager. The office of the company is located at 514 Columbia Building, Cleveland, Ohio.

THE SISTERSVILLE BOILER WORKS, of Sistersville, W. Va., has been incorporated with a capital stock of $25,000 by E. A. Ryan, J. P. Ryan, H. W. McCoy, S. G. Messer and A. C. Jackson, all of Sistersville, W. Va.

THE WARD MOTOR VEHICLE COMPANY, Borough of Bronx, New York, N. Y., has been incorporated by C. A. Ward, W. B. Ward and L. S. Kafer, of New York, N. Y. The company is capitalized at $200,000 and proposes to manufacture engines, motors, machinery, etc.

THE WOODS ELECTRIC VEHICLE COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $25,000 by Louis E. Burr, Thomas Clements and A. B. Schaeffer.

New Incorporations.

MARION, ALA.—The Marion Electric Company has filed articles of incorporation with a capital stock of $10,000 by T. J. Krouse, E. L. Krouse, R. H. Cox, R. S. Ellis and others.

SAN FRANCISCO, CAL.—The Poulsen Wireless Company has been incorporated with a capital stock of $100,000 by G. H. Russell, C. K. Melrose, A. J. Freuler and A. J. Chalmers.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Levy Electric Company, with a capital stock of $25,000, by L. E. Norris, Louis and P. Levy.

SAN FRANCISCO, CAL.—The Owens River Valley Electric Railway Company has been chartered with a capital stock of $200,000 to build an electric railway in the Owens River Valley. The directors are: Curtis Hillyer, E. A. O'Brien, G. Carter, R. C. Pardoe and T. W. Forsyth, all of San Francisco, Cal.; M. R. Jones, of Oakland, Cal., and D. D. Oliphant, of Berkeley, Cal.

ATHOL, IDAHO.—The Athol Water & Light Company has been organized to establish a public service plant in Athol.

KAMIAH, IDAHO.—The Harrisburg Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of erecting a telephone line from Kamiah to Pardee, a distance of sixteen miles. The incorporators are: E. L. Gallaher, Frank Finney, L. B. George, Anders Bolander and F. E. Harris.

RAYMOND, IDAHO.—The Raymond Telephone Company has been incorporated with a capital stock of $10,000 by Thomas H. Munford, George Hall and others.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Porter, Chesterton & South Shore Railway Company by C. N. Wilcoxen, F. J. Lewis Meyer, F. M. Childs and J. M. Chilas, all of South Bend, Ind. The company is capitalized at $40,000 and proposes to build an interurban electric railway between Porter and Chesterton to a junction with the main line of the Chicago, Lake Shore & South Bend Railway near Baileytown.

MOORESVILLE, IND.—Articles of incorporation have been filed for Mooresville Water, Light, Heat & Power Company, with a capital stock of $100,000, by Everett L. Duepree, Clarence Duepree and Edwin H. Emrick. The company proposes to supply water, light and heat in the towns of Mooresville, Brooklyn and Monrovia.

PAOLA, KAN.—Articles of incorporation have been filed for the People's Electric Light Company with a capital stock of $15,000. The company is constructing a power plant and will supply electricity for lamps and motors in Paola. It is expected to have the plant completed by Jan. 1, 1911.

DONALDSONVILLE, LA.—The Lafourche Valley & Gulf Railway Company has been incorporated with a capital stock of $1,500,000 for the purpose of building an electric railway from Donaldsonville to Leesville, on the west bank of Bayou Lafourche, a distance of ninety miles. Telephone and telegraph lines will be erected for dispatching trains. The officers of the company are: F. M. Welch, president; J. Numa Colomb, vice-president; Charles Maurin, secretary and treasurer.

SHERMAN, MICH.—The Iosco & Arenac Telephone Company has been organized to install and operate a mutual telephone system. The officers are: John Jordan, president; Robert Wilkins, vice-president; Walter Pringle, secretary and treasurer.

BLOOMING PRAIRIE, MINN.—Articles of incorporation have been filed for the Blooming Prairie Farmers & Merchants' Telephone Company with a capital stock of $50,000. The officers are: Carl B. Campbell, president; Paul P. Moffett, vice-president; Leonard Virtue, secretary, and E. W. Cooley, treasurer, all of Blooming Prairie, Minn.

ST. LOUIS, MO.—The Denverside Connecting Railway Company has been incorporated with a capital stock to construct and operate a belt railway in East St. Louis, Ill. The incorporators are: H. S. Kramer, Arthur W. Baltz and George C. Keller, all of East St. Louis, Mo.

ATKINSON, NEB.—Articles of incorporation have been filed for the Sheridan Telephone Company with a capital stock of $2,500 by M. Gunderinger, W. T. Hayes, Peter Goff and others.

SEWARD, NEB.—The Blue River Power Company has been incorporated with a capital stock of $100,000 by Burdette Boyes, C. E. Boyes, E. J. Ashton and others.

CAMDEN, N. J.—The South Penn Railway & Light Company has applied for a charter with a capital stock of $4,500,000 under the laws of

the State of New Jersey. The incorporators are: V. A. Murray, D. Billinger and J. R. Bradley, of Pittsburgh, Pa.

SPRAY, N. C.—The Spray Utilities & Terminal Company has been chartered with a capital stock of $500,000 by S. H. Marshall, E. V. Hobbs and N. H. McCollum. The company proposes to construct and operate water power electric plants and railways, etc.

KENTON, OHIO.—The Hardin-Wyandott Lighting Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: W. B. Whiting, C. C. Owens, Sterling Newall, Ellis R. Diehm and Donald McBride.

KILBOURNE, OHIO.—The Kilbourne Mutual Telephone Company has been incorporated by Charles F. Rodenfels, Claude S. Van Sickle, Charles W. Humes and William W. Tegley.

HYDRO, OKLA.—The McCool Telephone Company has been chartered with a capital stock of $500 by Frank M. Saunders, L. N. Cody, W. E. Inlow, C. E. Cole and F. R. Arnold, all of Hydro, Okla.

PORTLAND, ORE.—The Stein Mountain Power & Irrigating Company has been chartered with a capital stock of $25,000 by A. O. Jones, G. G. Jones and T. Burns.

BOSWELL, PA.—The Boswell Electric Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are: C. J. Gundelfinger, 900 Pittsburgh Bank for Savings Building, Pittsburgh, Pa.; Lucien Hill and Floyd B. Lockhart, all of Pittsburgh, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the Antis Electric Light, Heat & Power Company, the Snyder Electric Light, Heat & Power Company, the Valley Electric Light & Power Company and the Warriorsmark Electric Light, Heat & Power Company. Each company is capitalized at $10,000 and the directors are: Walter W. Perkins, of Philadelphia, Pa., treasurer; C. L. S. Tingley, of St. Davids, Pa.; Frank J. Pryor, Jr., Joseph M. Walsh and John Armstrong, all of Philadelphia, Pa.

LAKE COMO, PA.—The Northern Wayne Telephone Company has been granted a charter with a capital stock of $5,000.

PITTSBURGH, PA.—The Woodlawn & Southern Street Railway Company has been incorporated with a capital stock of $75,000 to construct an electric railway seven and one-half miles in length in Beaver County. The incorporators are: J. B. Shepherd, of Pittsburgh, Pa., president; John L. Moon, Ralph E. Reyner, John W. Adams and Walter L. Copeland, of Pittsburgh, Pa.

GOUDYVILLE, S. D.—The Union Telephone Company has been formed with a capital stock of $1,000 by L. F. Bogeurief, of Goudyville, S. D., president; John Endfield, of Dunsmore, S. D., and John Kozel, of Zeigler.

DALLAS, TEX.—The Dallas Automatic Telephone Company has been incorporated with a capital stock of $500,000 to construct an automatic telephone system in Dallas. The incorporators are: F. X. Eberle, J. C. Casier, H. D. Eberle and others.

PORTLAND, TEX.—The Portland Rosita Telephone Company has been chartered with a capital stock of $1,500 by D. C. Rachel, E. A. Rachel and P. A. Hunter.

ROYSE CITY, TEX.—The City Mill & Light Company has been incorporated with a capital stock of $12,000 by J. N. Miller, E. M. Paug, J. D. Miller and W. H. Adams.

POAGES MILL, VA.—The Fruit Growers' Telephone Corporation has been chartered with a capital stock of $5,000. The officers are: J. T. Henry, president; J. D. Willett, vice-president, and W. C. Wertz, secretary and treasurer.

STRASBURG, VA.—The Strasburg Light & Manufacturing Company has been granted a charter with a capital stock of $50,000 for the purpose of establishing an electric light plant in Strasburg.

EATONVILLE, WASH.—Articles of incorporation have been filed for the Mount Tacoma Telephone & Telegraph Company with a capital stock of $3,000 by A. E. Dye, I. Dye and others.

ORCHARDS, WASH.—The Orchards Telephone Company has been organized by G. J. Mitchel and E. C. Curtain.

SEATTLE, WASH.—The West Coast Light, Power & Water Company has filed articles of incorporation with a capital stock of $500,000. The incorporators are: Albert N. Moughin, Alfred P. Dobson and S. F. Bradbury.

SEATTLE, WASH.—Articles of incorporation have been filed for the Commercial Wireless Telephone & Telegraph Company with a capital stock of $1,000,000 by Fred H. Shoemaker, Lumber Exchange Building, Seattle, and John Bradfield.

CREWE, W. VA.—The Crewe Electric Light Company has been incorporated with a capital stock of $25,000 for the purpose of operating an electric light plant. The officers are: W. L. Willis, president; C. E. Wilson, vice-president; S. E. Moore, secretary and treasurer.

GRAFTON, W. VA.—Articles of incorporation have been filed for the Grafton Light, Heat & Power Company with a capital stock of $200,000 by John T. McGraw, A. S. Wardner, Jr., Charles R. Durbin, A. Hood Phillips and John T. McGraw, Jr., all of Grafton, W. Va. The company proposes to operate street railways, water, light and power plants.

MELLEN, WIS.—Articles of incorporation have been filed for the Peoples Water, Light & Power Company with a capital stock of $50,000 by Robert Johnson and others.

MOSINEE, WIS.—Articles of incorporation have been filed for the Mosinee Electric Company, with a capital stock of $15,000, by Neal Brown, C. S. Gilbert and M. C. Ewing.

OCONTO FALLS, WIS.—The Morgan Telephone Company has been incorporated with a capital stock of $1,200 by C. F. Meyer and Adolph Peterson.

Personal.

MR. H. G. STOTT, who has been quite ill from an attack of typhoid fever, is now on the way to recovery of health.

MR. WILLIAM H. NEVILLE has opened an office in the Audubon Building, New Orleans, for practice as a contracting electrical engineer.

MR. THOMAS J. WALSH, formerly of the Stone & Webster Corporation, Boston, has taken up consulting work as a mechanical and electrical engineer, with offices at 140 Milk Street, Boston.

MR. W. R. WHEATON, formerly of the United States Forestry Department, is in charge of a creosote pole-treating plant being established near Fresno, Cal., by the San Joaquin Light & Power Company.

MR. W. L. KIMBALL, who has been the treasurer of the American Transformer Company, of Newark, N. J., since its organization, has disposed of his interest and resigned his position, his resignation having taken effect on Dec. 1.

MR. JULIUS MARTIN, expert electrical aid, Brooklyn Navy Yard, read a paper entitled "Side Lights on the Navy Department Wireless Telegraph Specifications" at a meeting of the Wireless Institute, New York, on Wednesday evening, Dec. 7.

MR. J. B. ADAMS, formerly in charge of the Colgate power plant of the Pacific Gas & Electric Company, of San Francisco, has been made superintendent of the De Sabla power division, vice J. B. Adams, who has resigned to go to South America. The Colgate hydroelectric plant is now in charge of Mr. Joseph Mini, Jr.

MR. C. M. RAY, formerly assistant general manager of the California Gas & Electric Corporation, and who has been identified with the electrical industry in California for the past twenty-five years, has presented a lengthy argument in the *California Weekly* in favor of a State public service commission for the regulation of public utilities.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, of Chicago, has been appointed a member of the Forest Preserve Commission approved by the voters of Chicago at the recent election. This commission, unless some legal obstacle intervenes, will establish a belt of outer parks surrounding Chicago—a subject in which Mr. Insull is greatly interested.

MR. W. R. BONHAM, representing in Chicago the Sterling Electrical Manufacturing Company and the Triumph Electric Company, is ill at his home, with a severe attack of typhoid fever, from which at this writing he is reported, happily, to be recovering. Mr. Bonham attended the recent illuminating engineering convention and lectures in Baltimore, and his illness appears to date back to that time.

MR. WILLIAM H. BRYAN, until recently a consulting electrical engineer in St. Louis, has accepted formal appointment as chief engineer of the Chicago public school system, and has removed to Chicago to enter upon his new duties. Mr. Bryan was appointed after a civil service examination, in which he led all the other candidates. The position pays $6,000 a year. Mr. Bryan's office will be at the headquarters of the Board of Education, 143 Dearborn Street.

Obituary.

MR. CHARLES JOSEPH DE BERARD died suddenly at his residence in Norwood Park, Chicago, on Nov. 28. He was born in Racine, Wis., on Aug. 17, 1849, and for twenty-five years he was associated with Mr. Robert Tarrant in the machine-shop business. At the time of his death he was a director in the Tarrant Foundry Company and also secretary and treasurer of the Felt & Tarrant Manufacturing Company, the latter manufacturing the comptometer. Mr. de Berard was a man of the highest character, and his manliness and transparent integrity endeared him to his friends. He is survived by a widow, three daughters and two sons.

Trade Publications.

REGULATORS.—The General Electric Company has issued bulletin No. 4602-B, a new edition of its publication on automatic voltage regulators for direct-current generators.

CHRISTMAS TELEPHONES.—As a suggestion for a Christmas present, the Stromberg-Carlson Telephone Manufacturing Company, Rochester, has issued a circular illustrating a box in Christmas trappings containing a set of magneto telephones.

COMPRESSOR COILS.—With the title "A Word About Compressor Coils," the Henry Fire-Proof Company, 1733 Broadway, New York, has issued a circular presenting the advantage of Heany fireproof wire for use in electric railway air-compressor coils.

MOTOR-DRIVE ELEVATORS.—The Westinghouse Electric & Manufacturing Company has just issued section 3103 of its perpetual catalogue 3002-A on the subject of motor-driven elevators. The section contains a number of illustrations of typical installations.

VENTILATING FANS.—The American Blower Company, Detroit, Mich., has issued as bulletin No. 284 a forty-eight page publication giving complete descriptions of its Sirocco fans and blowers, which are of the turbine type.

ATTACHMENT PLUGS.—In a neat folder entitled "A Word to the Wives," Harvey Hubbell, Inc., Bridgeport, Conn., is distributing to the trade an attractive mailing folder showing the various uses to which the Hubbell attachment plugs can be put. The plugs are shown used with reading lamps, chafing dishes, ventilating fans and flatirons.

MINIATURE LAMPS.—The General Electric Company has issued booklet No. B-3004, describing miniature decorative incandescent lamps. The lamps are illustrated in color and various designs representing fruits and flowers are shown. These lamps are used for decorating Christmas trees and also in connection with set pieces of artificial shrubs, trees, etc.

STORAGE BATTERIES.—The Electric Storage Battery Company, Philadelphia, Pa., has issued Bulletin No. 126, devoted to oil insulators for supporting storage cells. Bulletin No. 127 of the same company contains a well-prepared description of the carbon regulator for use in connection with the charging circuits of storage batteries.

EXCITER PANELS.—Bulletin No. 4782 of the General Electric Company illustrates and describes exciter panels for use in connection with alternating-current generator panels, when for any reason separate control of the exciter is desired. The bulletin contains a complete description of these panels, as well as diagrams of connections and dimensions.

AUTOMOBILE LIGHTING.—The Ward-Leonard Electric Company, Bronxville, N. Y., has issued an illustrated mailing folder giving a brief description of its automatic generator automobile lighting system. The automobile is equipped with a storage battery, and when the car is run at a speed exceeding ten miles per hour the generator supplies energy both for the lighting devices and for charging the battery.

BLUE-PRINT MACHINERY.—The C. F. Pease Company, Chicago, Ill., has issued a handsome 96-page catalogue in which is described and illustrated in detail its line of automatic blue-printing machinery. The blue-printing machines are, of course, run by electric motors and equipped either with arc lamps or mercury vapor lamps. The machines are made for papers from 24 in. to 54 in. wide, and for ordinary blue prints, as well as for direct white prints and negative and black line prints.

GARVIN MACHINES.—The Garvin Machine Company, Spring and Varick Streets, New York, has issued circulars No. 135 and 152, the former illustrating and describing its No. 2A universal milling machines, and the latter its No. 2 hole-grinding machines. The former is adapted for machine shop tool rooms, tool making, gear cutting shops and as a special tool for manufacturing fluted shafts, spiral gears and twist drills with constant angles. The hole-grinding machine has a capacity for ⅞ to 4-in. holes by 4 in. long.

IGNITION CATALOG.—The Connecticut Telephone & Electric Company, of Meriden, Conn., has issued a 1911 catalog covering the well-known automobile and motorboat ignition specialties. The catalog describes the new Connecticut magneto in detail and gives a clear and concise account of the various systems for which this is made. Other new types for 1911 illustrated are the new Connecticut shock absorbers, hinged bracket spark coils, magneto lock switch, steering-wheel switch, pocket meters and Connecticut auto lock.

SIGNALS.—In Bulletin No. 4786 issued by the General Electric Company a description is given of a simple and reliable motor signal having a signal mechanism suitable for either two or three position operation in either the upper or the lower quadrant. This standard mechanism is also applicable to either top or bottom mast operation with but slight modifications. The bulletin contains nearly ninety pages of information, including exterior and interior views of the signal and a detailed description of the signal and apparatus used in connection with its operation.

ARC LAMPS.—The General Electric Company has issued as pamphlet No. B-3006 a reprint of a paper read by Mr. W. D'A. Ryan before the National Electric Light Association on the subject of "Street Illumination." This pamphlet compares the results obtained from the use of luminous and flame arc lamps with those resulting from the use of open and inclosed carbon arc lamps. The subject is treated from the standpoint of the illuminating engineer and is discussed in detail. The pamphlet contains half-tone illustrations, showing street illumination by luminous arcs in various cities. There are also numerous diagrams. The subject is treated exhaustively and should be of assistance to all interested in this branch of engineering.

MAGNETO TELEPHONE SETS AND ACCESSORIES.—The Western Electric Company has just issued Bulletin No. 1116, describing magneto telephone sets and accessories. The bulletin, which contains forty pages, is profusely illustrated. Several pages are devoted to the design and construction of wall and desk sets, and the No. 1317 type wall set is described with attention to the smallest details. It is stated that $10,000 was spent in designing this set before the first model was approved, and that the set has a record of a quarter million of sales in twenty months. It has been made the standard for service on thousands of rural lines and in the circuits of mines and railroads, both steam and electric. A double-page cut shows the characteristic features of this telephone. The bulletin describes and lists backboards, batteries, battery boxes and gages, binding posts, buzzers, condensers, cords, desk set boxes, desk stands, flexiphones and flexiphone arms, generators and generator boxes, gongs and gong mountings, hand sets, induction coils, number plates, protectors, protector blocks, fuses, micas and mats, receivers, ringers, switch hooks, test sets, transmitters and transmitter arms and brackets.

PANELS AND CABINETS.—The Crouse-Hinds Company has issued what deserves to be called an "édition de luxe" catalog of its line of panels and cabinets. The catalog, which has flexible covers and handsome end-papers, is 9 x 12 in. in size and is profusely illustrated in two colors. The copper, slate, black-enameled steel and grained-wood parts of the different articles illustrated are shown in fidelity of detail and coloring. Color is also used to good effect in the rule work, the soft shade employed being a relief from the solid black and guiding the eye unconsciously across or down the tabulated pages. Each detail of construction is described concisely, and listings and prices of individual and assembled parts are presented so clearly that no reason can be found for a misunderstanding. Panels and cabinets are listed both separately and together, which is a convenience appreciated by contractor and jobber alike. In fact, the entire catalogue, aside from its artistic qualities, is as near perfection in orderly arrangement and presentation of facts as has yet been attained. From cover to cover it reflects many months of intelligent and conscientious labor devoted to its production and is the worthy representative of a concern noted for the excellence of its products. Anyone in a position to make use of this catalogue can secure a copy by addressing a request to the Crouse-Hinds Company, Syracuse, N. Y.

BUSINESS NOTES.

THE NOVELTY INCANDESCENT LAMP COMPANY has removed its general offices from Emporium, Pa., to 1733 Broadway, New York.

THE CHICAGO FUSE WIRE & MANUFACTURING COMPANY, formerly at 215-223 South Clinton Street, has moved to 1014 West Congress Street, Chicago.

THE SHELBY ELECTRIC COMPANY, of Shelby, Ohio, manufacturers of all types of incandescent electric lamps, has just opened a branch office at Room No. 1102, Candler Building, Atlanta, Ga. This office will be in charge of Mr. H. G. Scott.

THE MASSACHUSETTS CHEMICAL COMPANY, manufacturers of liquid electrical insulation, tapes and splicing compounds, is moving into the extensive additions to its plant at Walpole, Mass., which comprise a new four-story manufacturing building, a four-story reclaiming building and a new power plant, together aggregating about three acres of floor space.

WILLARD STORAGE BATTERY OFFICES.—The Willard Storage Battery Company announces that Mr. F. S. Gassaway, formerly manager of the New York branch, has been transferred to the main office, Cleveland, Ohio, where he will act as general manager of sales. In addition to the New York office, the Willard company has branches in Detroit, Chicago and in Mexico City.

MOORE TUBES.—Weidmann & Company, the big silk dyers of Paterson, N. J., and the oldest and leading dyers in the United States, selected the white Moore tube lamp to illuminate their display of silk dyed in the skein at the recent Industrial Exposition at Paterson, N. J. The white Moore tube lamp is now being used by nearly fifty of the biggest dyeing concerns in the United States, leaders in all branches of the textile industry.

H. W. JOHNS-MANVILLE COMPANY MOVES TO LARGER QUARTERS.—Owing to greatly increased business the H. W. Johns-Manville Company announces the removal of its offices now located at 85 Shelden Street, Houghton, Mich., to more commodious and convenient quarters at 96 Shelden Street. As in the past, Mr. S. T. Harris, who has been associated with the company for a number of years, will be in charge of the offices at the new address.

THE YORK MANUFACTURING COMPANY reports quite an active business in ice-making and refrigerating machinery during the past two months. Among these are a five-ton ice-making plant for the Edna (Tex.) Ice & Light Company; twenty-ton, complete ice-making plant for the Houma (La.) Light & Ice Manufacturing Company, and one fifteen-ton machine for the Kennett (Mo.) Ice & Electric Company. Among the sales were quite a number of machines of more than 100-ton capacity.

THE WAGNER MANUFACTURING COMPANY of St. Louis, has appointed Mr. L. C. Bassett as its sales representative for the western part of New York State with headquarters in Buffalo. Mr. Bassett has for some time been the manager of the apparatus department of Messrs. McCarthy Bros. & Ford who have represented the Wagner Company in this territory. McCarthy Bros. & Ford will continue their representation of the Wagner Company in the counties of Erie and Niagara and Mr. Bassett will make his office in their building, 41-43 East Eagle Street.

NEWARK'S DISASTROUS FIRE DESTROYS ELECTRICAL PLANT.—The fire in Newark, N. J., last week, which resulted in the loss of more than twenty lives, destroyed the plant of the Anchor Lamp Company and the Ætna Electric Company, which occupied the third floor of the building burned. A girl employee of the Ætna Electric Company was cleaning an electric light fixture in a gasoline bath, and the gasoline took fire and trickled in a little rivulet of flame on the floor, where stood a full can of gasoline. The can exploded, the burning liquid flew far and wide, and the fire spread rapidly to every part of the building.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED, NOV. 28, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

976,836. ELECTRIC ANNUNCIATING APPARATUS; H. J. Alther, Boston, Mass. App. filed March 18, 1909. Hotel annunciator to show whether the room is occupied by circuits controlled from the lock by the presence or absence of a key.

976,838. CIRCUIT OPENER; C. C. Badeau, Swissvale, Pa. App. filed April 27, 1905. A fixed and movable contact, an electromagnet and pivoted armature for releasing the member and a roller journaled in the operating member.

976,839. TROLLEY-GUARD; E. Eisele, West Carrollton, Ohio. App. filed Nov. 19, 1909. The lower side of the guard has flanges and rollers are mounted on the trolley rod to engage the flanges.

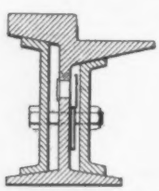
976,878. ELECTRICAL SYSTEM OF DISTRIBUTION; A. G. Hubbard, Bellesville, N. J. App. filed June 19, 1908. A storage battery regulating system with resistance across the circuit and a regulating dynamo with two field coils, one of which is connected to a point in the resistance, with means for causing the magneto motive force of the coil to respond to changes in load.

976,939. STREET TRAFFIC SYSTEM; E. E. Sirrine, Chicago, Ill. App. filed April 28, 1910. Changeable sign for controlling traffic, so as to indicate that the cross streets are either open or closed to traffic.

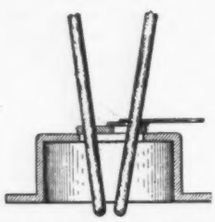
976,942. TROLLEY POLE; C. M. Speck and C. F. Earl, Chicago, Ill. App. filed March 18, 1909. A second frame is carried by the main frame and a yielding arm carries a contact wheel and is capable of sidewise movement.

976,944. ELECTRIC HEATING RECEPTACLE; W. Stanley, Great Barrington, Mass. App. filed May 13, 1909. A flat, perforated metal disk with flat heating unit, cast in the center, so that the cast metal extends through the perforations.

976,947. RAIL-BOND; Chas. R. Sturdevant, Worcester, Mass. App. filed June 25, 1910. A flexible member with terminals at the ends and a layer of solder thereon for increasing the conductivity of the ends.



976,947.—Rail-Bond.



977,022—Electric-Arc Lamp.

976,961. COMBINED TELEPHONE AND SERVICE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Jan. 6, 1908. A central source of current with means for transmitting special impulses by steady current and preventing interference with the telephone service currents thereby.

976,962. WALL SET; A. H. Weiss, Chicago, Ill. App. filed June 17, 1908. Telephone wall plate with back plate and ringer and bell posts extending from the ringer and spaced from the plate and a box cover opening downwardly to expose the apparatus of the set.

976,990.—Electrode.

976,990. ELECTRODE; J. T. H. Dempster, Schenectady, N. Y. App. filed July 20, 1905. An electrode consisting of metallic oxids with an easily fusible compound at its arcing end.

977,008. TELEGRAPH SYSTEM; G. E. Hines, New York, N. Y. App. filed April 13, 1907. A main line grounded at each end with closed transformers with secondaries in series with the line and key controlled primaries and relays with polarized armatures in series with the line restrained against movements due to stray currents and an adjustable self-induction device in series with the conductor.

977,022. ELECTRIC-ARC LAMP; W. Legel, Berlin, Germany. App. filed Feb. 2, 1910. The electrodes converge and an economizer is provided with aperture for the electrode which is sealed by two guy plates each pivoted to the next lower plate.

977,058. ELECTRIC CUT-OUT; B. M. Walpole, Providence, R. I. App. filed March 18, 1909. An insulating tube with conducting ends and spring plates on the ends with a fused linked strip extending through the casing beyond the ends into the contact plates and held in place by fuse blocks.

977,061. MEANS FOR MEASURING CURRENT IN THREE-PHASE SYSTEMS; C. Wiler, Chicago, Ill. App. filed Jan. 7, 1909. A transformer in two of the mains, an electrical measuring instrument, and spring jaw switches normally connecting the transformers in parallel to the instrument with a plug for separating the jaws.

977,067. CENTRAL STATION CALL SYSTEM FOR TELEPHONE LINES; W. E. Butler, David City, Neb. App. filed Feb. 15, 1909. A rotatable pole changer is driven by a direct-current motor with means for coupling the source of current to the motor and to the pole changer and then to the line, with a transformer connected to the source of current through the pole changer.

977,073. LOCKING MECHANISM FOR CONTROLLING HANDLES; A. S. Cunitt, Schenectady, N. Y. App. filed Nov. 9, 1905. The handle carries and conceals a pawl which engages a notched member to stop it at points in the forward movement. The pawl is released by the backward movement of the handle.

977,074. VOLTAGE REGULATED ELECTRIC LIGHTING SYSTEM FOR RAILWAY AND OTHER CARRIAGES; James Dalziel, Derby, Eng. App. filed Sept. 27, 1904. A main generator, a motor, a variable potential generator on the shaft of the motor which may be connected as a booster or counter electromotive force in circuit with the exciting coils of the main generator when it reaches a predetermined potential to vary the excitation.

977,086. ELECTRICAL ELEMENT; A. T. K. Estelle, Fliseryd, Sweden. App. filed May 20, 1909. Positive electrode for alkaline batteries consisting of nickel hydrate as active material mixed with a conductor, i. e., powdered graphite and cadmium oxide.

977,111. MAGNETIC BRAKE DEVICE; J. N. Mahoney and O. S. McCurdy, Wilkinsburg, Pa. App. filed April 20, 1908. Magnetic brake operated by a magnet to throw it against the rail.

977,114. RELAY; R. H. Manson, Elyria, Ohio. App. filed June 1, 1906. Spring contact relay with an annular armature pivoted to the flux bar, which latter carries contact springs with points accessible from the front, which springs are spaced apart.

977,123. PANEL BOARD; R. H. Olley, Syracuse, N. Y. App. filed July 27, 1908. A section of insulating material with a busbar groove in the rear and a recess in the front on the same plane as the groove and joining it.

977,125. APPARATUS FOR CONTINUOUS ELECTROLYSIS OF AQUEOUS SOLUTIONS; A. Pietzch, Triberg, German and Ewald Steinbuch, Monthey, Switzerand. App. filed Nov. 17, 1909. Two superposed electrodes in different compartments with means for causing the electrolyte to flow from the upper to the lower electrode with a support of permeable non-conducting material between them to receive the salt.

977,140. ELECTRIC SWITCH; P. L. Sibole, Wilkinsburg, Pa. App. filed Sept. 20, 1909. An electric switch with two movable switch elements mutually engaging, and connections between the switch elements and an actuating element.

977,142. TELEPHONE SYSTEM; F. X. Staub, Fort Wayne, Ind. App. filed April 8, 1910. The receiver has a soft iron core with a serial winding in the line and a non-inductive shunt about the receiver winding in series with the transmitter.

977,145. PRIMARY BATTERY PLATE; A. O. Tate, Toronto, Ont., Canada. App. filed Feb. 25, 1908. Interleaved positive and negative sections separated by porous material, the positive sections connected together at one end and the negative at the other, the parts secured by insulating bolts.

977,156. ELECTRIC TRUCK; A. F. Batchelder, Schenectady, N. Y. App. filed April 7, 1906. Electric truck with truck frame and motor armature on one axle and field magnet upon the end member of the frame.

977,187. SWITCH BOX; G. Gut, Seebach, near Zurich, Switzerland. App. filed July 6, 1910. The box with its cover and switching shaft on the cover and auxiliary shaft in the box wall. When the cover is closed the two shafts are coupled.

977,193. OIL BREAK SWITCH; H. J. Hunsicker, Albany, N. Y. App. filed May 29, 1907. Switch with oil pot and pressure pot and single insulator supporting one pot upon the shoulder and the other upon its head.

977,198. COOLING VANE FOR SECOND-CLASS GLOWER LAMPS; A. Kusebauch, Pittsburgh, Pa. App. filed Nov. 11, 1908. An inclosing shell for the lamp, with a ballast tube and resilient cooling vanes surrounding the tube between it and the shell.

977,219. ELECTRICAL SIGNALING SYSTEM; C. H. Pool, New York, N. Y. App. filed May 2, 1910. A signal translating device with transmitter for sending impulses, loops in the circuit and means for operating on a brake or ground in a loop to control the transmitter in sending impulses.

977,220. DYNAMO-ELECTRIC MACHINE; W. H. Powell, Norwood, Ohio. App. filed July 30, 1906. A dynamo with core having toothed laminæ, some being thicker at the end of the group than the rest and with successively shorter teeth.

977,224. TROLLEY POLE; R. F. Robinson and H. A. Owen, Whitinsville, Mass. App. filed Nov. 30, 1909. A trolley pole having parallel springs, a trolley head at the upper ends of the springs and a link connecting the upper part of the pole with the head.

977,250. INCLOSED DYNAMO-ELECTRIC MACHINE; A. H. Wouters, Norwood, Ohio. App. filed March 1, 1907. High-speed machine with air ventilation.

977,262. INSULATING HANGER; N. J. Bigham, Detroit, Mich. App. filed April 28, 1910. A pair of hanging hooks with the noses turned toward each other and a belaying projection carried thereby.

977,294. ELECTRICAL FLASHER; A. S. Gibbs, Scranton, Pa. App. filed Dec. 21, 1908. A rotary cylinder containing mercury and contact blades in different compartments.

977,295. ELECTRICAL THERMOSTATIC ALARM SYSTEM; A. Goldstein, New York, N. Y. App. filed May 2, 1910. A case with a diaphragm operated by air expansion, the diaphragm making, then breaking, then making the circuit and sounding an alarm after the second make.

977,296. CENTRAL ENERGY ELECTRICAL TEMPERATURE ALARM SYSTEM; A. Goldstein and C. H. Pool, New York, N. Y. App. filed June 3, 1910. A line circuit connecting distant stations with a translating device at one station and a transmitter at the other which is controlled by a certain frequency current.

977,303. ELECTRIC FURNACE; J. Harden, London, Eng. App. filed May 7, 1909. Induction type of furnace the walls of which consist of a mixture of a refractory material and a suitable conductor.

977,328. ELECTRICAL EQUALIZING SYSTEM; R. Richter, Grunau, near Berlin, Germany. App. filed May 16, 1910. An alternating-current circuit, a dynamo therein, one of the members of which rotates continuously and the magnetic axis of one of the members being shifted in accordance with the load.

977,335. MEANS FOR FILTERING AIR AND PRODUCING OZONE; S. C. Shaffner, Chicago, Ill. App. filed May 10, 1909. A casing, a screen therein, a step-up transformer, a connection from one terminal of the high-tension winding to the screen and means for passing the air through the screen, the core of the transformer heating the air.